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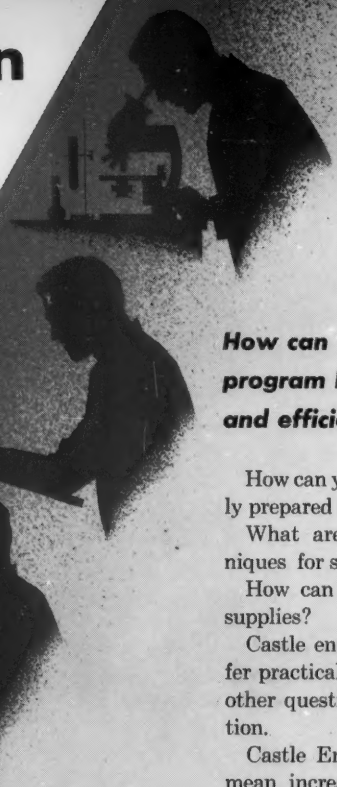

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To Help Improve Quality

Sharply contrasting attitudes toward the best use of federal funds for support of education are evident in three types of legislative proposals now before Congress. One type proposes federal aid for school construction. Such proposals were defeated in 1956 and 1957, but the idea continues to have appeal because the issue of federal control of education is clearly avoided. A second type proposes unrestricted federal grants to augment state and local school budgets. The National Education Association and school officials who would determine the use of the funds find this idea attractive. The third type is represented by the Administration and the Hill-Elliott bills [for details, see *Science* **127**, 389 (21 Feb. 1958)]. The two are similar in detail and identical in purpose: to use federal money selectively to raise the quality of education. This objective is supported by those who reject the easy dictum, "There's nothing wrong with education that more money won't cure," and who believe that additional federal money should be directed toward the educational needs of highest priority.

This last point of view is given strong support in *The Pursuit of Excellence*, the most recent in the "America at Mid-Century" series of reports from Rockefeller Brothers Fund (published 23 June 1958). This admirable analysis of current educational problems is the work of a panel that was chaired initially by James R. Killian, Jr., and later by John W. Gardner. It presents no detailed recommendations for legislative or other action, but forcefully demonstrates the urgent necessity of raising quality standards from the elementary school on up.

Senate and House committees have held extended hearings on education bills. The House Committee on Education and Labor is expected to bring out a new bill soon, perhaps before this gets into print. Details are not yet known, but emphasis will be on quality. Likely to be included are funds, either on a matching or full-grant basis, for counseling and guidance programs, employment of counselors to help inexperienced teachers of science, mathematics, and (perhaps) foreign languages, purchase of laboratory equipment, research on teaching methods, scholarships and student loans, and perhaps other measures.

Both in scholarship plans and in programs for improving teaching, emphasis will be on science and mathematics. Some critics whose interest in the welfare of science cannot be questioned would rather see no federal scholarship program than one restricted to prospective scientists and engineers. The bill will almost certainly compromise on this issue—as it will on others—by favoring science and engineering students without being exclusively for such students. Political necessity requires such an approach, for unless the bill can be supported on national defense grounds it will have no chance of passage. Such a bill also merits support on the grounds that it is a good start and will lead the way for similar improvements in other important fields, such as English and history.

The chances seem good that the House will have an opportunity to debate and vote on the new bill, and that if it passes before the last mad rush for adjournment it will also pass the Senate. The big question is how the vote will go in the House. Public and press support has faded badly since last winter. Some business and education leaders, scientists, academies of science, and others have endorsed the general provisions of the Administration and Hill-Elliott bills, and it is a bill such as these that this year appears to have the best chance of adoption, but recent evidence of support has not been great enough to have much impact. Without widespread support, last winter's bright hope that this is the year for constructive federal legislation to raise the quality of education will continue to grow dimmer and dimmer.—D.W.

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4 July 1958, Volume 128, Number 3314 SCIENCE

Early Cambrian Marine Fauna

A new hypothesis that can in some measure be tested explains its origin in terms of coastal sites.

Daniel I. Axelrod

One of the major unsolved problems of geology and evolution is the occurrence of diversified, multicellular marine invertebrates in Lower Cambrian rocks on all the continents and their absence in rocks of greater age (*1*, *2*). These Early Cambrian fossils included porifera, coelenterates, brachiopods, mollusca, echinoids, and arthropods (see *3* for details of the groups). In the Arthropoda are included the well-known trilobites, which were complexly organized, with well-differentiated head and tail, numerous thoracic parts, jointed legs, and—like the later crustaceans—a complex respiratory system. From a phylogenetic standpoint the Early Cambrian faunal assemblage is generally interpreted to represent rather simple ancestral types in their respective phyla, which rapidly diversified into numerous types (species, genera, families, orders) during and following the Early Cambrian. Their high degree of organization clearly indicates that a long period of evolution preceded their appearance in the record. However, when we turn to examine the Precambrian rocks for the forerunners of these Early Cambrian fossils, they are nowhere to be found. Many thick (over 5000 feet) sections of sedimentary rock are now known to lie in unbroken succession below strata containing the earliest Cambrian fossils. These sediments apparently were suitable for the preservation of fossils because they often are identical with overlying rocks which are fossiliferous, yet no fossils are found in them. Clearly, a significant but unrecorded chapter in the history of life is missing from the rocks of Precambrian time.

Dr. Axelrod is on the staff of the University of California, Los Angeles, in the department of geology.

Explanatory Theories

Numerous theories have been advanced to explain this hiatus in the geologic record of the Precambrian evolution of marine invertebrates. The older ideas have been adequately reviewed by Raymond (*4*) and Seilacher (*2*) and need only be listed here, because none is adequate to explain the record: (i) Any Precambrian fossils which may have been preserved were destroyed by metamorphism. (ii) Precambrian fossils had no skeletons because there was no calcium in the sea. (iii) Precambrian oceans were acid, thus preventing the formation of calcareous skeletons. (iv) Precambrian strata were deposited on land in fresh water of low calcium content. (v) Marine life originated in fresh water and thence migrated down the rivers to reach the oceans by Cambrian time. (vi) Precambrian life lacked hard parts suitable for preservation because life was confined to the surface waters, where skeletons would have been of little use. (vii) Skeletons suddenly appeared due to the adoption of a sessile or sluggish mode of existence on the sea bottom.

More recently expressed views are those of Snyder (*5*), who visualizes the Precambrian existence of a fauna which was as diversified and complicated as that of the Early Cambrian and which, while not otherwise significantly altered, abruptly acquired hard parts owing to environmental (physical and biotic) stress; Schindewolf (*6*), who believes that there were no forerunners of the Cambrian fauna but that it suddenly appeared due to "*Grossmutation*"; and Seilacher (*2*), who agrees with Schindewolf (*6*) about the evolution of the Cambrian fauna and also believes that the soft-bodied benthonic types which formed the trace-fossils (trails, tracks, burrows) of the Precambrian suddenly changed their activities in a similar manner at the beginning of the Cambrian. None of these more recently proposed theories appears acceptable because they do not conform to our present understanding of the evolutionary process (see 7, chap. 4; *8*, p. 347).

There are, however, two other theories pertaining respectively to the biologic and geologic aspects of the problem which, with suitable modifications, may be integrated to provide a further theory, which appears both consistent with the record and capable of a measure of empirical test.

Cloud (*8*) has suggested that if the Early Cambrian fauna was derived from types that were undergoing eruptive evolution of the type visualized by Simpson (*7*, *9*) during the late Precambrian, the problem of their sudden appearance in the record might partly be solved. Judging from the nature of the evidence the suggestion has much merit. However, the question as to why there are no records of these marine invertebrates, which must have had hard parts suitable for preservation prior to the Cambrian, remains unanswered. The immediate forerunners of the Cambrian fauna presumably were rather widespread, to judge from the world-wide distribution of the Early Cambrian fauna, yet we have no records of them. And as mentioned, since the sediments underlying the oldest fossiliferous zone frequently are types which suggest physical environments similar to

those of the fossil-bearing strata, there is no apparent reason why the fossils should not have been preserved.

A clue as to why this early phase of evolution is missing occurred to me during a current review of the evolution of land plants. There is much evidence to suggest that the new, major categories (orders and classes) of plants have evolved chiefly in areas of environmental diversity, notably in the uplands, in sites well removed from the lowland basins of deposition where most fossils have been preserved (*10*). A similar environment has been postulated for the evolution of the phyla, classes, and orders of nonmarine vertebrates (*7, 9*). In both cases, fossils representing ancestral types in the eruptive stage of evolution are missing from the record, or at least are very rare. This is chiefly because these types comprised rather small populations living in sites remote from lowland basins of deposition or because, if they did get into the nonmarine record occasionally, those deposits have largely been eroded and the records have been lost (*11*).

Coast-line Hypothesis

Owing to analogous circumstances, the problem of the evolution of the late Precambrian marine fauna may thus be resolved in terms (i) of the nature of the areas or sites in which the phyla were evolving and (ii) of the subsequent geologic history of these areas, as a result of which most of the record has not been preserved. Walcott (*12*) considered this problem and coined the term "Lipalian" for "the era of unknown marine sedimentation between the adjustment of pelagic life to littoral conditions and the appearance of the Lower Cambrian fauna." He believed that the pelagic life of the ocean had already become adapted to benthonic, littoral, and near-shore environments by later Precambrian (Algonkian) time but that no record of it was preserved because the continental platforms were above sea level; he felt that any sediments containing remains of this early fauna may be concealed beneath the present oceans. Thus, when the seas encroached on the base-leveled continents at the close of the Precambrian, they brought with them the littoral fauna which had been developing during Lipalian sedimentation. Walcott believed that the sediments which lie in unbroken sequence below the fossiliferous marine Cambrian beds represent continental deposits formed during the later Precambrian, an opinion based chiefly on the absence of marine fossils in them. Most investigators are now agreed that the nonfossiliferous sections which conformably underlie the earliest Cambrian faunas are largely marine, not continental, as Walcott supposed. In other words, the continental platforms were not wholly elevated above sea level but were inundated here and there by broad Precambian seas, much as they were during the Cambrian and later periods.

With respect to the environment of early evolution, the littoral and immediate shore area would almost certainly have been ideal for the Precambrian marine invertebrates. Warm water, ample sunlight, a large supply of mineral nutrients, and dense plankton populations for food would have been in continuous existence. Further, a great diversity of habitats is typical of all shore areas. Local variations in topography, rapid changes in bottom type (rocky, sandy, muddy), or slight differences in temperature or depth or salinity would clearly have resulted in a wide array of ecologic niches (for other factors, see *13*). Fragmentation of populations into discrete interbreeding units would inevitably have developed during Precambrian time. Microgeographic isolation in these areas of abrupt and diverse changes in environment would permit the existence of divergent adaptive types in proximity. The tempo of evolution would quicken, and with strong selection in operation, a host of types would now enter an eruptive phase of evolution. As Walcott has suggested, this early phase may have been proceeding in the immediate coastal strip for a long time prior to the Cambrian. We can agree with Cloud (*8*) that ancestral members of the Cambrian fauna probably were evolving at a high rate, but this alone cannot explain the absence of multicellular, hard-shelled marine invertebrates in the Late Precambrian. Actually, we could scarcely expect much of a record of any fossils that may have been preserved in the near-coastal environment. The hinge line between land and sea is not broad and is eroded as soon as the area is only slightly elevated. Further, if evolution was progressing chiefly in the warmer parts of a broad tropical zone, the area in which fossils might have been preserved through the vicissitudes of more than 550 million years of earth history is further reduced, while the persistence of the record of the environment would appear even less likely.

According to the present hypothesis, therefore, Precambrian faunas were evolving in favorable coastal sites, in areas where any fossiliferous sediments which may have accumulated probably would not have survived the effects of erosion down to the present day. During the eruptive phase of Precambrian evolution the fauna presumably was confined to the near-shore and littoral belts by food requirements, temperature, depth and changes attendant upon it, and a host of other factors which were affecting the physiology of the organisms concerned. In the closing parts of the eruptive phase we may infer that relatively "advanced types" were radiating out into a new environment—the neritic zone—to which they quickly became adapted. These, presumably, are the Early Cambrian descendants of the later Precambrian fauna. They represent types which had evolved sufficiently so that they could invade the relatively deeper parts of the continental shelves and epeiric seas, where they formed the well-known record of the communities of that time. Their earliest appearance in the record probably was due not to a simultaneous migration into deeper waters as the Cambrian began but rather to a gradual deployment into the extralittoral region during an interval of several million years (*14*). This deployment most probably was not only to seaward and into deeper water but also in the relatively cooler, though probably warm, regions at higher latitudes.

This coast-line hypothesis, which has been briefly outlined here, appears to offer certain unifying advantages in that (i) it has the merit of simplicity; (ii) it provides the conditions that are believed requisite for eruptive evolution; (iii) it is consistent with geologic evidence that the site of early evolution probably would not be preserved for long periods of time, and (iv) it can, at least in some measure, be tested.

The Shore as Collecting Area

By conducting careful current-directional studies of Precambrian sediments in selected critical areas it may be possible to find remnants of the old shore line and its fauna; in any event, such studies should bring us closer to the shore as a likely site for collecting. In searching for fossils in these areas we must remember that the more primitive members of phyletic stocks were generally small, as compared with their derivatives. The remarkable living relict *Hutchinsonella*, a

cephalocarid-trilobitoid crustacean only 3 millimeters long (*15*), is highly suggestive in this connection. If the primitive Precambrian brachiopods and trilobites and their associates were also quite small, as seems likely, the amount of organic debris that may have been preserved is considerably reduced, the fossils will not be readily visible, and the probability of discovery is lessened. Examination of Precambrian sediments by suitable microscopic, isotopic, and chemical methods may reveal particles of shell fragments and other structures of the ancestral coast-line fauna mixed in with these transported sediments. Organic microstructures of this sort will not be common in Precambrian rocks. Fossils are rare in any event, and with life less abundant in the seas of Precambrian time, the chances of finding these transported materials are correspondingly low (*16*, *17*).

References and Notes

1. We are concerned here only with the remains of multicellular, hard-shelled organisms which make up the bulk of the record and not with "trace-fossils" such as trails, burrows, tracks, and other signs of the activities of soft-bodied bottom dwellers whose systematic relations are unknown and which occur in Precambrian rocks. For a discussion of organisms of the latter type, see A. Seilacher (*2*).
2. A. Seilacher, *Neues Jahrb. Geol. u. Paläontol.* 103, 155 (1956).
3. R. R. Schrock and W. H. Twenhofel, *Principles of Invertebrate Paleontology* (McGraw-Hill, New York, ed. 2, 1953).
4. P. E. Raymond, *Bull. Geol. Soc. Am.* 46, 375 (1935).
5. F. G. Snyder, *J. Geol.* 55, 146 (1947).
6. O. H. Schindewolf, *Der Zeitfaktor in Geologie und Paläontologie* (Schweizerbart'sche, Stuttgart, Germany, 1950).
7. G. G. Simpson, *The Major Features of Evolution* (Columbia Univ. Press, New York, 1953).
8. P. E. Cloud, Jr., *Evolution* 2, 322 (1948).
9. G. G. Simpson, *Tempo and Mode in Evolution* (Columbia Univ. Press, New York, 1944).
10. D. I. Axelrod, *Evolution* 6, 29 (1952).
11. For a more complete discussion and documentation of this argument, see *7*, *9*, and *10*.
12. C. D. Walcott, *Smithsonian Inst. Publs. Misc. Collections* 57, 1 (1910).
13. R. H. Fleming, *Geol. Soc. Am. Mem. No. 67* (1957), vol. 1, p. 87.
14. The problem of their exact time of appearance in the record rests in part on determining the synchroneity of the base of the Cambrian across the world. Since the earliest faunas are meager in number and distinctive type and, also, display important regional differences, precise correlation of widely separated areas is not readily possible. There is a strong probability that the basal Cambrian fossiliferous rocks are not of exactly the same age everywhere in the world; some appear to be older than those of the type section in Wales.
15. H. L. Saunders, *Systematic Zool.* 6, 112 (1957).
16. For critical comments and suggestions I am indebted to C. A. Nelson, Alexander Stoyanow, and E. L. Winterer of the Department of Geology, University of California, Los Angeles; to Robert E. Smith, Department of Physiology, University of California Medical School, Los Angeles; to Joel W. Hedgpeth, director, Pacific Marine Station; to James Gilluly and Preston E. Cloud, Jr., U.S. Geological Survey; to Ralph W. Chaney and J. Wyatt Durham, Department of Paleontology, University of California, Berkeley; and to Eliot Blackwelder, Hubert G. Schenck, and A. Myra Keen, School of Mineral Sciences, Stanford University.
17. This paper is an outgrowth of studies in paleobotany which have been generously supported by the National Science Foundation.

American Use of Soviet Medical Research

A study of 500 medical scientists shows that they make comparatively little use of Soviet work.

Saul Herner

During the past several years there has been a growing interest in the United States in Soviet scientific research. This interest has arisen in part from the political concern of the United States in the over-all activities of the Soviet Union and in part from a growing awareness of an acceleration of activity in science and technology in the Soviet Union since World War II.

One outgrowth of the increased interest in Soviet science has been a program organized by the National Institutes of Health to make Soviet medical research information more readily available to American medical scientists. This program was instituted at the request of the Committee on Appropriations of the United States Senate. It grew out of testimony at the 1956 appropriations hearings of the Department of Health, Education, and Welfare, during which it was observed that Soviet medical scientists are keenly aware of American developments in medicine but that American medical scientists know very little about Soviet medical research activity. The presumed advantage that Soviet medical scientists have over the American scientists is twofold. First, the Soviet scientists benefit from a broad and intensive foreign-information-gathering and translation program in the Soviet Union which covers practically every area of science and practically every nation's literature; second, where American medical research information is concerned, the average Soviet scientist has the advantage of having a fair working knowledge of the English language.

This article (*1*) is an account of the findings of an interview study which was performed at the request of the National Institutes of Health to define the extent and character of the need for Soviet medical research information among American medical scientists and to evolve the best means of meeting this need. The study was also designed to analyze the present mechanisms of use of Soviet medical research information among American medical scientists. In cases where Soviet research information was not being used, it was also the purpose of the study to ascertain and evaluate the reasons for the lack of use. Among the questions considered in ascertaining the reasons for any established lack of use of Soviet information were those of the respondents' familiarity with Soviet work in their fields of science and their general attitudes toward the Soviet Union and Soviet science.

Derivation and Character of the Sample

The sample for the study consisted of 500 American medical scientists. These scientists were drawn from 59 medical research organizations in six American cities. The organizations represented hospitals, medical schools, government agencies, pharmaceutical firms, and independ-

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Table 1. Respondents' use of, and ability to read, foreign-language literature.

Foreign language	Respondent			
	Encounters most often (%)	Can read (%)	Has read in past 6 months (%)	Has read abstract in past 6 months (%)
German	89	87	62	26
French	71	87	60	21
Spanish	18	28	12	5
Italian	15	28	13	2
Russian	5	6	3	0
Scandinavian	4	7	3	1
Japanese	3	1	1	0
Dutch	2	5	2	0
Other	4	13	4	3
None	4	4	20	63

ent research institutions. The cities in which organizations were chosen for study were New York, Philadelphia, Baltimore, Washington, Chicago, and Cleveland. These cities were chosen because they represented a concentration of medical research activity. The 500 scientists interviewed represented all of the major fields of medical research. The median age of the respondents was 36. Forty-five percent had M.D. degrees; 45 percent had Ph.D. or D.Sc. degrees; and the remaining 10 percent had various other scientific degrees.

The specific organizations from which the respondents were drawn were selected from such reference works as the National Research Council's *Industrial Research Laboratories in the United States and Canada,* the American Council on Education's *American Colleges and Universities,* and the National Science Foundation's *Grants and Contracts for Unclassified Research in the Life Sciences.* The selection of organizations for study was intentionally skewed so that places most likely to have facilities for obtaining and utilizing Soviet information would dominate the sample. This was done to alleviate an anticipated (and subsequently justified) fear that if the sample were completely random it would contain so few respondents having experience with Soviet medical research information as to limit severely the implications and significance of the study.

Representativeness and Statistical Dependability of the Sample

In view of the intentional bias in the selection of organizations for study, it is obvious that the sample cannot be considered representative of all medical research activities in the United States. The conclusions and implications drawn from the study are valid only for the specific organizations in the sample.

Statistically, with the limitations noted, the sample of respondents drawn is of an adequate size to ensure a fairly high degree of quantitative dependability. With a sample of 500, the maximum sampling error is in the vicinity of 4 percent. Furthermore, as a result of the method of sampling, in which the number of respondents chosen in each organization was a function of its proportionate size, and in which the individual respondents were selected randomly, there is reasonable assurance that the sample constitutes a proportionately representative profile of the limited universe.

Interviewing

The interviews were conducted by a staff of trained interviewers, all of whom were experienced in face-to-face interviewing techniques. To supplement their past experience and training, each of the interviewers was carefully oriented as to the nature and purposes of the study. This training was done by means of lectures and demonstrations, mock interviews, and trial interviews.

Draft schedules were prepared and pretested on medical research personnel in organizations outside the sample orbit. At the end of the pretesting, indicated editorial changes were made in the draft schedules, and the final schedules were drawn up.

While the majority of the questions in the schedule were of the precoded or check-off type, they were kept sufficiently open-ended to permit answers other than those anticipated. The interviewers were instructed to record verbatim all information volunteered by respondents in answer to questions. In the case of discussion questions, the interviewers probed to obtain the most detailed answers possible. The average interview consumed approximately an hour and a quarter.

Linguistic Ability and Use of Foreign-Language Literature

For purposes of obtaining background information against which the relative use of Soviet information might be measured, each of the respondents was asked a series of questions about the foreign languages he encountered most frequently in his professional reading, his linguistic abilities, and his actual use of foreign-language publications in the previous six months.

As might have been expected, German and French were by far the most frequently encountered foreign languages. After German and French came Spanish and Italian. Next came Russian and Scandinavian, followed by Dutch.

In order to develop data on linguistic abilities, each of the respondents was asked to list all languages that he could read with reasonable facility. For the purposes of the present study, being able to read a language with "reasonable facility" was defined as being able to get through a scientific or technical paper in that language with the aid of a dictionary. As in the case of foreign languages encountered, German and French stood out as the foreign languages in which the greatest proportion of the respondents had reading ability. Following German and French were Italian and Spanish. Next came Scandinavian languages, Russian, Dutch, and Japanese (see Table 1).

Further detail on the use made of foreign-language literature was obtained by asking each of the respondents whether he had read any technical literature in foreign languages in the previous six months and, if so, in what languages. The answers paralleled those obtained from the previous two questions. Sixty-three percent of the respondents had read technical literature in German in the previous six months; 60 percent had read literature in French; 13 percent in Italian; 12 percent in Spanish; 3 percent in Russian; 3 percent in Scandinavian languages; and 2 percent in Dutch. Twenty percent of the respondents had not read any technical publications in a foreign language during the previous six months.

Degree of Use of Soviet Information

In order to establish a dependable basis for defining the type and extent of use of Soviet information by the respondent group, each respondent was prescreened by means of a question which asked whether or not he had sought or obtained any information on Soviet research in his field during the previous six months. Those respondents who answered the question affirmatively were asked a series of detailed questions which they were to answer on the basis of their actual recent experience with respect to Soviet information. Those respondents who had not sought or made use of Soviet information in the previous six months were asked another set of questions, designed to establish the reasons for this lack of use.

As it turned out, slightly less than half of the respondents had sought or made use of Soviet information in the previous six months. The majority of the preclinical scientists had sought or obtained Soviet information in the previous six months, and the majority of the clinical scientists had not.

Methods of Obtaining Soviet Information

The first question that was put to the respondents who had sought or obtained Soviet information was where they had obtained it (if they had succeeded in obtaining it). As it developed, these respondents used a variety of tools and methods in getting it.

The primary means was through the indexing and abstracting publications. The second most general method of obtaining Soviet research information was through English-language papers, including review papers, in which Soviet developments were discussed. The third most important source of Soviet information was the translated paper or book. The fourth most frequently cited means of obtaining Soviet information was through reports from recent visitors to the Soviet Union or through personal conversations with such persons. Fifth in importance were papers in the Russian language and abstracts and proceedings of meetings. Then came translated editions of Soviet journals and attendance at international meetings, followed by conversations with visitors from the Soviet Union.

As a means of evaluating the usefulness of the various methods and tools for obtaining access to Soviet information, each of the respondents who had had experience with such information in the previous six months was asked what method or tool he considered most valuable in obtaining it. The overwhelming answer was, indexing and abstracting publications.

Ways to Learn of Soviet Information

In order to determine whether medical scientists use different methods to apprise themselves of Soviet information from those they use to get information from other countries, each of the 500 respondents was asked how he became aware of the existence of scientific information in general, of foreign-language information in general, and of Soviet information. As it developed, there were significant differences.

In the case of scientific information in general, the average respondent used 7.6 different tools or methods for learning of the existence of useful information; for foreign-language information, the average number of tools or methods was 4.4; for Soviet information, this number was 1.6.

In all three cases, the most prominent tools or methods were indexing and abstracting publications, footnotes or cited references, personal recommendations, and personal reference files. However, there is an interesting shift in the relative importance of these tools or techniques as one goes from information in general, to foreign-language information in general, to Russian information (Table 2).

When asked how they became aware of information in general, the respondents placed cited references and indexing and abstracting publications on an approximately equal level of importance, with personal recommendations and personal reference files slightly behind. In the case of foreign-language information in general, the significance of cited references diminished slightly and the significance of indexing and abstracting publications rose. Where only Soviet information was concerned, the significance of indexing and abstracting publications rose to nearly twice that of cited references. Personal recommendations also rose in importance.

The element of chance or accident was relatively great for all three types of information. However, there is a definite diminution in the role of chance or accident as one goes from information in general, to foreign-language information in general, to Soviet information. This pattern would seem to relate to the falling off in the number of bibliographic tools used by the respondents in their efforts to learn of Soviet and other foreign-language information, as opposed to information in general.

Indexing and Abstracting Publications

In all, 40 different indexing and abstracting publications were mentioned by the respondents as having been used for locating or learning of Soviet information. The one most frequently mentioned was *Chemical Abstracts*; this was followed, in order of rank, by *Biological Abstracts, Current List of Medical Literature, Chemisches Zentralblatt, Excerpta Medica, Translation Monthly, Library of Congress Bibliography of Translations from Russian Scientific and Technical Literature* (2), *Library of Congress Monthly List of Russian Acces-*

Table 2. Tools or methods for locating, or becoming aware of sources of, information about Soviet medical research, used in the past 6 months.

Tools or methods	For information in general (%)	For foreign information (%)	For Soviet information (%)
Footnotes or other cited references	97	79	29
By chance or accident, while looking through publications	96	70	31
Indexing and abstracting publications	95	86	53
Personal recommendations	88	61	25
Personal reference files	81	49	10
Book reviews	70	26	4
Library card catalogs	69	17	2
Publishers' advertisements	67	16	1
Library acquisition lists	59	21	4
Separate bibliographies	42	16	5
Other	2	2	13
Average No. of methods used	7.6	4.4	1.6

sions, Psychological Abstracts, Quarterly Cumulative Index Medicus, Leukemia Abstracts, and the Consultants Bureau's list of available Soviet translations. It is interesting to note, in further confirmation of the narrowing of the variety of bibliographic tools and techniques used in specialized literature, that the use made of the first five indexing and abstracting publications named was greater than that made of the remaining 35 combined.

Soviet Journals

Another measure of the use that is made of Soviet literature and Soviet information is the degree to which the respondents endeavor to see Soviet journals on a frequent or regular basis. In order to develop data on this point, each of the respondents who had sought or made use of Soviet information during the previous six months was asked whether there were any specific Soviet journals that he saw either regularly or occasionally.

Of the 240 respondents who had sought or obtained Soviet information in the previous six months, 58 did see specific Soviet journals on a regular or occasional basis. The median number of journals named by the respondents was one, although several named as many as five. Eight of the respondents who saw Soviet journals with some frequency saw them in translated form.

In all, 15 Soviet journal titles were named by the respondents who did see Soviet journals. These titles, in order of rank, by number of times mentioned (figures in parentheses), are as follows: *Biokhimiya* (16), *Zhurnal Obshchei Khimii* (10), *Doklady Akademii Nauk S.S.S.R.* (8), *Byulleten Eksperimental'noi Biologii i Meditsiny* (7), *Fiziologicheskii Zhurnal S.S.S.R. imeni I. M. Sechenova* (4), *Mikrobiologiya* (3), *Biofizika* (2), *Meditsinskaya Parazitologiya i Parazitarnye Bolezni* (1), *Sovetskaya Meditsina* (1), *Terapevticheskii Arkhiv* (1), *Voprosy Virusologii* (1), *Zhurnal Analiticheskoi Khimii* (1), *Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii* (1), *Zhurnal Nevropatologii i Psikhiatrii imeni S. S. Korsakova* (1), and *Zhurnal Priklad'noi Khimii* (1).

As still another means of establishing the use made of Soviet publications, each of the respondents who had had experience with Soviet information in the previous six months was asked whether he had had any Soviet material translated during this period. Forty-four had, 184 had not, and 12 did not answer. The bulk of the translated items were papers from Soviet journals. For the most part, the translations were made within the respondents' own organizations, either formally, when staff translators were available, or informally, by colleagues, staff members, and similar personnel.

Evaluations of Soviet Journals

In answer to a follow-up question on how the Soviet journals compared with their American counterparts, none of the respondents who saw Soviet journals on a regular or occasional basis thought them superior; 18 thought them equal to their American counterparts; 25 thought the Soviet journals inferior; and 15 did not express an opinion. Along with the value judgments as to the relative merits of Soviet journals, a record was kept of the verbatim remarks of the respondents on the subject.

The remarks took many different forms and covered many areas. However, they can be distilled down to the following points: In over-all quality, the Soviet journals seen by the respondents vary, like all journals, from good to bad. But, in general, they are inferior in quality to comparable American journals. The papers are often uninteresting, they leave out important details, and they are poorly documented. The theories expounded in the papers are not modern, although an occasional novel idea seeps through. There is an overemphasis on applied science, to the detriment of coverage of basic science. The papers do not appear to be politically slanted.

Table 3. Respondents' opinions of current Soviet medical research.

Evaluations	Respondents		Both groups (%)
	Had sought or obtained Soviet information in past 6 months (%)	Had not sought or obtained Soviet information in past 6 months (%)	
Don't know, or no opinion	30	60	46
Good, or adequate, or equal to U.S.	33	13	23
Of inferior or questionable quality	30	23	26
Varies from good to bad	8	3	6

Reasons for Not Using Soviet Information

To turn now to the question of why over half of the respondents had not sought or obtained any Soviet research information during the previous six months, the primary reasons stated were lack of accessibility and lack of familiarity. First, it was felt that there are no fully adequate keys to make the American scientist aware of the existence of pertinent Soviet information, and that, if there *are* keys, they are not being sufficiently publicized. Second, the nonusers expressed the feeling that they could not obtain up-to-date Soviet publications. Third, there was the language barrier and the difficulty of obtaining translations when and as they are needed. Fourth, there was the problem of inadequate contact, correspondence, and exchange of information with Soviet scientists on a person-to-person basis. This was related, in the minds of a number of the respondents, to security restrictions imposed by both the United States and Soviet governments. Fifth, and related to the fourth problem, was a lack of familiarity with notable Soviet workers in fields of interest to the respondents. Sixth, there was an ignorance of what the Soviet Union is doing in pertinent fields and of whether it is worth looking into.

In addition to the problems of inaccessibility and unfamiliarity, there was a proportion of the respondents who did not believe that the Soviet medical scientists were doing work in subjects of immediate interest to them. Coupled with this was the feeling of many of the respondents that the Soviet work in their fields was on a low technical level and unreliable. Finally, there was the overriding problem of inertia: A large percentage of the respondents who had not sought or obtained Soviet information in the previous six months, when asked whether there was any particular reason for this, answered that they simply felt no specific need for Soviet information, that they were not in the habit of looking

for it or using it, or that they did not have time to look for it. Related to these attitudes is the remark of a number of the respondents to the effect that, in seeking information, they did not single out any countries in particular but were interested in pertinent work wherever it was being done.

Accessibility of Soviet Information

In order to probe a bit deeper into the over-all problem of accessibility, each of the respondents was asked specifically whether he considered Soviet information in his field to be readily available to him. In cases where the respondent answered "no," he was asked to describe any particular problem that he had encountered in obtaining Soviet information. In answer to the first question, 6 percent of the respondents considered Soviet information readily available to them; 76 percent did not consider it readily available; and 18 percent did not know. Of the respondents who did not consider Soviet information readily available, 54 percent had never tried to obtain it. This merely reemphasizes the fact that the small use that is made of Soviet information by American medical scientists is due, in large measure, to a simple lack of interest in it. In all other respects, the problems described as posing barriers to obtaining Soviet information were exactly the same as those described in answer to the question about why the respondent had not sought or used Soviet information in the previous six months.

Increasing Availability of Soviet Information

As a logical extension of the discussion of the availability of Soviet information, all of the respondents were queried about possible means of increasing its accessibility. The suggestions advanced fell into four general categories. The most widely recommended method for increasing the availability of Soviet information was by improving the coverage of Soviet literature by indexing and abstracting publications. This would seem to follow logically on the heavy reliance that is already placed on indexing and abstracting publications as a means of obtaining and learning of the existence of Soviet and other foreign-language information.

A number of the respondents (considerably fewer than those who wanted broader coverage in abstracting publications) suggested the dissemination of translated tables of contents of current Soviet medical periodicals. Actually, the Russians have made a start in this direction themselves by resuming the practice of including English-language summaries and tables of contents in their major medical science journals.

The second category of recommendations dealt with translations. There was fairly general agreement that some sort of translation service is needed to make Soviet information more readily and more cheaply available. There were a number of opinions about just what should be translated and how the needed translation program should be conducted. The largest segment of the recommendations was for facilities for having translations made on request, with the individual scientist ordering translations of specific items as he needs them. Then there was a group that suggested cover-to-cover translations of selected Soviet journals. A somewhat smaller group wanted translations of selected articles.

The third category of recommendations called for the fostering of more direct contact between the American scientist and the Soviet scientist through such devices as meetings in which American and Soviet scientists participate, the promoting and encouraging of exchange visits by American scientists to the Soviet Union and by Soviet scientists to the United States, and correspondence with Soviet scientists. A number of respondents emphasized the need for allaying the fears of many American scientists that keep them from making contact with Soviet scientists.

A fourth and final category of suggestions had to do with making the Soviet publications themselves more accessible. A number of respondents were concerned with the fact that, once they become better acquainted with Soviet work in their fields, through abstracts, cited references, and other means, they would develop a growing need for the literature cited or abstracted. They anticipated the frustrations which might arise from knowing of the existence of possibly useful material and being unable to get hold of it. A number of respondents expressed the opinion that, in many cases, abstracts or translations would not be sufficient, and that the original publications would be necessary. In order that these publications might be made available as needed, these respondents suggested establishing some sort of centralized or regional facility for distributing reprints and photostats of Soviet publications on request.

Evaluation of Soviet Medical Science

Eventually, whatever is done to improve the availability of information on Soviet science must be related to its quality. Obviously, if the quality of Soviet science is high in the eyes of American scientists, there is an inducement to obtain and make available more information about it. On the other hand, if the assessed quality of Soviet science is low, there would seem to be less point in undertaking any special efforts to make information about it available.

The respondents' opinions of the quality of Soviet journals have already been discussed. In addition to the matter of the quality of Soviet journals, each of the respondents was queried about his opinion of the quality of Soviet research in his field. For purposes of comparison, the answers obtained from those respondents who had made use of Soviet research information in the previous six months were separated from the answers of those who had not.

In general, the respondents' opinions of Soviet research were fairly evenly divided between "good" and "bad." Forty-six percent did not venture an opinion; 23 percent categorized it as either good, adequate, or on a par with American medical science; 26 percent considered it inferior or of questionable quality; and 6 percent thought the quality varied from good to bad (Table 3).

There was an interesting contrast between the opinions of the respondents who had sought or obtained Soviet information in the previous six months and those who had not. Among the respondents who had had some recent experience with information on Soviet science, 30 percent had no particular opinion about its quality; 33 percent were favorably impressed by it; 30 percent considered it inferior or of questionable quality; and 8 percent thought its quality varied from good to bad. Among those respondents who had not sought or obtained Soviet information in the previous six months, the opinions were reversed: 60 percent had no opinion; 13 percent considered Soviet science to be good, adequate, or comparable to our own; 23 percent considered it inferior; and 3 percent considered it variable.

Criticism of Soviet Medical Science

As is frequently the case, those respondents who were critical of Soviet science had much more to say to justify

their opinions than did those who were favorably inclined toward it. The primary criticism advanced by those respondents who were not favorably disposed toward Soviet science was that it is not trustworthy. The second most often expressed criticism was that the work of Soviet scientists is behind the times. Another fairly large group considered Soviet science to be politically biased (seemingly contradicting the group which considered Soviet research journals not to be politically biased—a group that was considerably smaller than the present one). Another comment, which was also made in connection with Soviet research journals, was that the Russians tend to overemphasize applications and are not interested enough in basic research.

In addition to the clearly critical comments, a number of the respondents stated that their lack of interest in Soviet science stemmed from the fact that the Russians and Americans work in different fields. This comment may serve to explain the earlier comment, made by a number of respondents, that the Russians are good in "other" fields. It could also explain the general apathy of the respondents toward Soviet science, although distrust and ignorance are also factors.

The gist of the favorable comments was that Soviet medical science is improving; that the Soviets used to do good work, and that this is an indication that they are capable of it; that they do good work in other fields (other than that in which the respondent is working); that they do good work in fields connected with warfare; that their scientific facilities are equal to ours; and that their freedom and lack of moral restriction in their conduct of experiments are a help to them. In addition to the foregoing comments, which encompass the views of the largest segment of the respondent group, a fair number of respondents used such adjectives as "highly imaginative," "unique," "uninhibited," and "fantastic" in their evaluations of Soviet science. It is difficult to say whether the last adjective is actually an accolade or a condemnation.

Knowledge about Soviet Workers

Another measure of the value placed on Soviet science by the respondents is their interest in the activities of specific workers in the Soviet Union. In answer to a question on the subject, 94 of the respondents named specific Soviet scientists whose writings they said they would like to see translated into English. They named a total of 96 different Soviet scientists. The average number named was two. There was an interesting repetition in the names mentioned, indicating independent agreement about the apparent importance of the Soviet scientists involved. One scientist, Braunstein, was named 15 times; another, Englehardt, was named 14 times; and a third, Smorodinzev, was mentioned 12 times. In a few cases, in naming Soviet scientists, it developed that the respondents were thinking of scientists they *used* to follow. While every effort has been made to correct for this in the tally, it is probable that a small percentage of the scientists named and counted are no longer living.

The ten scientists named most frequently were the following: Braunstein (biochemistry, enzymology), Englehardt (biochemistry), Smorodinzev (virology), Kritzman (biochemistry), Orbeli (physiology), Bykov (physiology), Beritoff (physiology), Palladin (biochemistry), Oparin (biochemistry), and Schumakov (virology, bacteriology). Actually, the fields covered by the Soviet scientists named practically run the gamut of preclinical and clinical medical science. In addition to the fields already mentioned, these included the following: biostatistics, cardiology, dentistry, dermatology, embryology, epidemiology, genetics, hematology, medicine, neurology, ophthalmology, pathology, pediatrics, pharmacology and therapeutics, psychiatry, radiology, and surgery. From the foregoing data, it is clear that the Soviet Union, like most other countries, has its "name" scientists, who are known and respected by their counterparts in the United States. There also is apparently good agreement about who these "name" scientists are.

Ratings of Soviet with Other Foreign Research

One other means used in the present study to elicit value judgments of the quality of Soviet medical research was to ask the respondents whether there were any other foreign-language countries whose research activities they would like to know more about, and to have

Table 4. Respondents' rating of Soviet medical research against medical research in other foreign-language countries.

Country	No. of times cited	No. of times ranked above U.S.S.R.	No. of times ranked below U.S.S.R.	No. of times ranked equal to U.S.S.R.	No. of times comparison with U.S.S.R. was not possible
Germany	106	53	10	1	42
Japan	90	33	26	4	27
France	60	23	4	1	32
Czechoslovakia	44	5	21	0	18
Italy	44	10	6	0	28
Sweden	37	14	1	0	22
Hungary	36	4	14	1	17
China	28	3	13	0	12
Poland	21	1	12	1	7
Switzerland	21	7	0	0	14
Argentina	20	5	5	0	10
Brazil	12	2	3	0	7
Denmark	10	6	1	0	3
Holland	10	5	1	0	4
India	10	1	4	0	5
Finland	9	0	3	0	6
Yugoslavia	8	1	6	0	1
Spain	7	1	0	0	6
Mexico	6	2	1	0	3
Austria	5	1	1	0	3
Israel	4	0	1	0	3
Norway	4	0	0	0	4
Belgium	3	1	0	0	2
Chile	3	0	2	0	1
South Africa	3	1	0	0	2
Portugal	2	0	0	0	2
Rumania	2	0	2	0	0
Cuba	1	1	0	0	0
Totals	606	180	137	8	281

them rate these other countries against the Soviet Union. This line of questioning produced a list of 28 countries. The countries named most frequently were Germany, Japan, France, Czechoslovakia, Italy, Sweden, Hungary, China, Poland, and Switzerland, in that order. Of these countries, Germany, Japan, France, Italy, Sweden, and Switzerland were generally rated above the Soviet Union, and Czechoslovakia, Hungary, China, and Poland were generally rated below.

On examining the list of countries cited (Table 4), it is clear that one of the greatest stimulants to the use of information is familiarity with its source. This is demonstrated by the expression of the need for more information from countries such as France and Germany, whose information is already abundantly available and heavily used. This expression of need may, of course, be related to the form in which American medical scientists prefer to get their German and French information; it may merely mean that they are not getting enough information on German and French research activities in the English-language articles and abstracts from which they ordinarily expect to obtain it.

To return to the question of how the respondents rated the countries they named in comparison with the Soviet Union, the fact that emerges most clearly is that the Soviet Union is an enigma to the American scientist; he cannot say with certainty how he would rate the Soviet Union against countries whose work he is familiar with. In the comparative ratings, there were 180 cases in which countries were rated above the Soviet Union, 137 cases in which countries were rated below the Soviet Union, eight cases in which the Soviet Union was rated equal to the countries mentioned, and 281 "don't know's." If the thesis that familiarity with a country's work stimulates interest in it is a correct one, the present lack of familiarity with the Soviet Union is likely to be self-perpetuating, unless some sort of artificial stimulus is utilized to alter the situation.

Conclusions and Implications

From the foregoing discussion, it is evident that lack of accessibility and a resulting lack of familiarity overshadow and limit the respondents' use of Soviet medical research information. The choices of methods for learning about pertinent Soviet activity are severely limited. The importance of indexing and abstracting publications in the case of Soviet information is heightened, and the importance of such prominent tools as cited references in the English-language literature is diminished. Authors apparently do not refer as much to Soviet publications as they do to those of other foreign-language countries. The reluctance or inability of authors to give greater attention to Soviet developments in their discussions and references has had a limiting effect on the methods available to the respondents for keeping abreast of Soviet work in their fields.

Another factor which has a limiting effect upon the respondents' use of Soviet information is their apparent unwillingness to read foreign-language literature. From the answers to questions about the respondents' ability to read foreign languages and their actual use of such literature, it is evident that linguistic ability alone does not ensure the use of foreign-language literature. However, this conclusion should be tempered by the understanding that reading in a language other than one's mother tongue is bound to be comparatively slow and difficult, and is bound to be avoided or at least infrequently practised because of sheer lack of time. This factor would undoubtedly limit the use of Soviet literature, even if it should become universally available and even if a large percentage of American scientists develop a reading knowledge of Russian.

It is possible that the present Soviet practice of including English summaries and tables of contents in Soviet medical journals will alter the situation somewhat by easing the language problem and ultimately making pertinent work in the Soviet Union more familiar to the American medical scientist. Perhaps this will be a means of curbing the distrust and lack of interest which presently characterize the American medical scientist's attitude toward Soviet research. A number of the respondents mentioned having read Soviet journals in the past when these included English summaries. Perhaps this activity will now be resumed, provided that pertinent Soviet journals are made available to would-be users.

On the other hand, increased accessibility of the information contained in Soviet journals could have exactly the opposite effect, by exposing current Soviet research to a degree of criticism which has not been possible in the past. It is possible that the availability of Soviet journals in a form which permits perusal will serve to amplify the critical attitudes of American scientists toward Soviet medical science. In a significant number of cases in the present study, respondents mentioned having been unable to duplicate experiments and results reported in Soviet journals. Such experiences are bound to color a scientist's attitude toward Soviet research and his interest in Soviet information even if the information is readily available.

But distrust or skepticism are not the only factors that may militate against the use of Soviet medical research information. The basic problem that makes it difficult to induce medical scientists in this country to make more use of Soviet research than they do is that they think in terms of subjects, not countries. When a biochemist wants to know what is being done in a given field of interest to him, he wants to know what is being done everywhere, and not in one particular country. Indeed, if he were to concentrate on specific countries, he would run the danger of getting only a part of the picture. One question that the respondents put to the interviewers continually in the present study was, "Why Russia in particular?"

Ultimately, Soviet medical information will have to meet the test of the market place and rise or fall on its merits. There is no question but that Soviet medical research information has been less readily available to American medical scientists than has information from other foreign-language countries. The primary benefits that will accrue from the inclusion of English titles and summaries in Soviet journals, and from the various steps that agencies such as the National Institutes of Health are taking to make Soviet medical literature more broadly accessible, will lie in the fact that American medical scientists will be able to accept or reject the results of Soviet research in exactly the same way that they accept or reject the research of scientists in other countries. Whether increased accessibility of Soviet medical information will give rise to a greater appreciation of Soviet research will depend ultimately upon the quality and nature of that research.

Notes

1. I wish to express my indebtedness to Robert S. Meyer for his very significant contribution to the execution of the study on which this article is based.
2. Publication of the *Library of Congress Bibliography of Translations from Scientific and Technical Literature* was discontinued in December 1956.

Gerty T. Cori, Biochemist

Gerty T. Cori (*nee* Radnitz), whose early death on 26 October 1957 was a great loss to biochemistry and the scientific world, was born in Prague, Czechoslovakia, then a part of the Austro-Hungarian Empire, in 1896. She attended secondary school in Prague and Teschen and became a medical student at the German University of Prague. She received her M.D. degree in 1920, together with a fellow student, Carl Ferdinand Cori, whom she married the same year. The association thus started was a lasting and happy one from the human point of view and, in terms of what it meant to science, one of the most fruitful and successful on record.

In 1922 Carl and Gerty Cori came to the United States, becoming American citizens in 1928. Until 1931 they worked at the State Institute for the Study of Malignant Diseases in Buffalo, New York, and in that year, following Carl's appointment to the chair of pharmacology at Washington University School of Medicine, they made their home in St. Louis, Missouri, where a son, Carl Thomas, was born to them in 1936. At the same university, Carl took over the chair of biochemistry in 1946, and Gerty became professor of biochemistry in 1947.

Their medical and physiological training gave Carl and Gerty Cori the background to correlate events at the molecular level with the processes in the body as a whole, and they became outstanding exponents of the group of medically trained scientists who, well versed in the physical and chemical sciences and deeply interested in biology, pioneered in the development of what is known today as dynamic biochemistry. Their lives followed more than just parallel courses; they followed a single, lofty, and straight course. This course of life they shared with their students and collaborators in a spirit of friendship and understanding which, with the integrity and excellence of their scientific leadership, resulted in high accomplishment.

It would be impossible to separate the contributions of Gerty from those of Carl Cori, as they always worked in close collaboration ever since their first joint publication in 1923. Their early work dealt with the fate of glucose in the animal body and the effect of hormones, such as insulin and epinephrine, on carbohydrate metabolism, a study which they would take up later with isolated enzymes following the discovery of key enzymes in the breakdown and synthesis of glycogen and utilization of glucose. The discovery of phosphorylase and of glucose-1-phosphate (Cori ester) and that of the branching enzyme (amylo-1, 4→1, 6-transglucosidase) led to our present understanding of the mechanism of biosynthesis of the highly branched glycogen molecule and to the first synthesis of this polysaccharide in the test tube. The discovery by Gerty Cori and her pupils of the enzyme amylo-1, 6-glucosidase, which cooperates with phosphorylase, phosphoglucomutase, and glucose-6-phosphatase in the biological cleavage of glycogen to glucose (glycogenolysis), completely elucidated the mechanism of this process. It further led to an elegant, and now classic, enzymatic analysis of the structure of glycogen by Gerty Cori and her collaborators. In recent years Gerty turned to the study of the "chemical lesion" in the glycogen storage disease of children and recognized two groups of disorders, one with normal and the other with abnormal glycogen, referable to deficiency of glucose-6-phosphatase in the former and to alteration in the branching or debranching enzymes in the latter. Gerty's indomitable, almost superhuman will kept her at work, with undiminished enthusiasm, through the weary years of failing health and dwindling physical strength, to produce some of her most outstanding scientific contributions.

In 1947 Carl and Gerty Cori shared with B. A. Houssay of Argentina the Nobel prize in physiology and medicine. With Marie Curie and Eve Jolliot-Curie, Gerty Cori was the third woman to receive a Nobel prize in science. Many other honors and distinctions, in some cases jointly with her husband, were bestowed upon her. She was not only a scientist of enormous stature but a human being of great spiritual depth, endowed with the most precious gifts that can adorn human nature. She was modest, kind, generous, and affectionate to a superlative degree and a lover of nature and art, living true to her statement: "honesty, which stands mostly for intellectual integrity, courage, and kindness are still the virtues I admire" ["This I Believe," a series of radio broadcasts by Edward R. Murrow (Columbia Records)]. Her attitude toward the riddle of the universe was expressed by her belief in the development of a philosophical system, based on the laws of physics, chemistry, and biology, without recourse to vitalistic ideas, although she warned that this hope should not be confused with the naive belief that human knowledge has no limits ["Some Thoughts on Science and Society," Sigma Xi Conference on Science and Human Responsibility, Oct. 1954, Washington Univ., St. Louis, Mo.]. She had faith in the moral progress of mankind but her youthful belief in rapid progress gradually gave way to a more realistic hope that there will be advance but a belief that it will be slow. In her own words, "Contemplation of the great human achievements through the ages is helpful to me in moments of despair and doubt. Human meanness and folly then seem less important. Humanity has but a short history of civilized life and the hope for greater wisdom must resign itself to a fairly distant future. Gone are the somewhat Utopian hopes of my youth, the belief in rapid, continuous progress. Hope remains, but the time scale has widened" ["This I Believe," a series of radio broadcasts by Edward R. Murrow (Columbia Records)].

Those who knew Gerty Cori admired the rare combination of human attributes which resulted in the harmonious personality that was so engaging, a rich, open personality in which an astonishing drive for action was uniquely blended with an unusually gentle, kind, and charming nature.

SEVERO OCHOA
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Severo Ochoa has been kind enough to encourage me to dwell on some facets of Gerty Cori's many-sided scientific work. In view of the general interest in "molecular biology," with special reference to heritable diseases in man, I have found it fitting to emphasize Gerty Cori's pioneer work in the field of biochemical genetics in man.

There are now several cases in which heritable human diseases and even "allergies," abundant in many races, can be traced back to a particular enzyme defect. Gerty Cori's studies on the glycogen storage diseases represent the first demonstration that a human heritable disease stems from a defect in an enzyme. In the hepatic storage disease a specific phosphatase, glucose-6-phosphatase, is missing. In the more involved disease which affects the muscle system, Gerty Cori's observations were even more remarkable. To my mind the most fundamental aspect of this particular study is the demonstration of the existence of abnormal short-branched, glycogen, "limit-dextrin (phosphorylase)," to use Gerty Cori's terminology, and its correlation with the absence (or defect) of the so-called debrancher enzyme, amylo-1, 6-glycosidase. The latter enzyme was also discovered by Gerty Cori. This outstanding piece of molecular biology was initiated early in 1950, stemming, of course, from Gerty and Carl Cori's earlier discoveries in this field. The demonstration that an aberrant architecture of a polymer is rooted in a well-defined enzyme defect still remains an unmatched scientific accomplishment. The ingenious enzymatic techniques employed here should be used as a teaching topic for students in biology, biochemistry, and medicine.

Gerty Cori was deeply interested in the broad aspects and implications of biological science. At the same time, she insisted on craftsmanship as the healthy basis for scientific work. She did not tolerate mediocrity or facile approaches in science. This is also reflected in the high demands that she made on her own labor. Her illness only served to intenstify these demands on herself. She exercised the same intense and warm enthusiasm in her active concern about the future of free human society. We shall all deeply miss her crusading spirit.

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News of Science

Passport Decision

The U.S. Supreme Court ruled in a five-to-four decision on 16 June that a person cannot be denied a passport because of his beliefs or associations. This ruling invalidates the State Department's regulations denying passports to Communists, to persons who refuse to sign non-Communist affidavits, and to those whom the Secretary of State believes would in some way help the Communist cause and injure the best interests of the United States by leaving this country. The Court decided the three cases before it on grounds of lack of statutory authority and thus avoided constitutional issues.

The cases involved artist Rockwell Kent and two scientists: Walter Briehl, Los Angeles psychiatrist, and Weldon Bruce Dayton, a physicist of Corning, N.Y. Kent and Briehl, whose cases were considered together, refused to answer State Department questions about Communist affiliations. They said they wished to travel abroad for pleasure and for professional reasons.

Dayton, who wanted a passport to take a job at the Tata Institute of Physics in Bombay, India, was accused of association with Communist espionage agents. He denied the charges under oath, but the Secretary of State refused him a passport on the basis of confidential information. There was a possibility that the Dayton case would provide a major test of the Government's constitutional powers to use secret informants. But the Court disposed of it on the statutory basis of the Kent-Briehl case.

Majority opinion. Justice William O. Douglas prepared the majority opinion. Joining him in the decision were Chief Justice Earl Warren and Justices Hugo L. Black, Felix Frankfurter, and William J. Brennan, Jr. Douglas wrote:

"Freedom of movement across frontiers in either direction, and inside frontiers as well, was a part of our heritage. Travel abroad, like travel within the country, may be necessary for a livelihood. It may be as close to the heart of the individual as the choice of what he eats, or wears, or reads. . . .

"Freedom of movement also has large social values. As Chafee put it, 'foreign correspondents and lecturers on public affairs need first-hand information. Scientists and scholars gain greatly from consultations with colleagues in other countries. Students equip themselves for more fruitful careers in the United States by instruction in foreign universities.' . . .

"[*Congressional intent.*] The difficulty is that while the power of the Secretary of State over the issuance of passports is expressed in broad terms, it was apparently long exercised quite narrowly. So far as material here, the cases of refusal of passports generally fell into two categories. First, questions pertinent to the citizenship of the applicant and his allegiance to the United States had to be resolved by the Secretary, for the command of Congress was that 'no passport shall be granted or issued to or verified for any other persons than those owing allegiance, whether citizens or not, to the United States.' . . . Second was the question whether the applicant was . . . engaging in conduct which would violate the laws of the United States. . . .

"The right of exit is a personal right included within the word 'liberty' as used in the Fifth Amendment. If that 'liberty' is to be regulated it must be pursuant to the lawmaking function of the Congress. . . . And if that power is delegated, the standards must be adequate to pass scrutiny by the accepted tests. . . . Where activities or enjoyment, natural and often necessary to the well-being of an American citizen, such as travel, are involved, we will construe narrowly all delegated powers that curtail or dilute them. . . .

"We must remember that we are dealing here with citizens who have neither been accused of crimes nor found guilty. . . . They may or may not be Communists.

"But assuming they are, the only law which Congress has passed expressly curtailing the movement of Communists across our borders has not yet become effective. It would therefore be strange to infer that pending the effectiveness of that law, the Secretary has been silently granted by Congress the larger, the more pervasive power to curtail in his discretion the free movement of citizens. . . .

"To repeat, we deal here with a constitutional right of the citizen, a right which we must assume Congress will be faithful to respect. We would be faced with important constitutional questions were we told that Congress . . . had given the Secretary authority to withhold passports to citizens because of their

belief or associations. Congress has made no such provision in explicit terms; and absent one, the Secretary may not employ that standard to restrict the citizens' right of free movement."

Dissent. Justice Tom C. Clark, who wrote the dissent, was joined in his opinion by Justices Harold H. Burton, John M. Harlan, and Charles E. Whittaker. Clark held that Congress had given the State Department ample authority to operate under its regulations. He traced the Secretary of State's broad discretion over passport issuance back to 1856 and found no limits on the Secretary's authority in the legislative history. Clark wrote in rebuttal:

"But the court then determines (i) that the Secretary's denial of passports in peacetime extended to only two categories of cases, those involving allegiance and those involving criminal activity, and (ii) that the Secretary's wartime exercise of his discretion, while admittedly more restrictive, has no relevance to the practice which Congress can be said to have approved in 1952 [the year possession of a passport for travel abroad became obligatory].

"Since the present denials do not involve grounds either of allegiance or criminal activity, the court concludes that they are beyond the pale of Congressional authorization. Both of the propositions set out above are vital to the court's final conclusion. Neither of them has any validity: the first is contrary to fact, and the second to common sense. . . .

"In a wholly realistic sense there is no peace today. . . . Were this a time of peace there might very well be no problem for us to decide, since petitioners then would not need a passport to leave the country. . . .

"Indeed, rather than being irrelevant, the wartime practice may be the only relevant one, for the discretion with which we are concerned is a discretionary control over international travel. Yet only in times of war and national emergency has a passport been required to leave or enter this country, and hence only in such times has passport power necessarily meant power to control travel."

In an article in the *Washington Post* Clark is quoted as saying that the decision is a "blow" to the national security. He further observed: "This decision in effect strikes down all travel control until Congress acts."

Reaction. In editorials approving the Court's decision, both the *New York Times* and the *Washington Post* urged Congress to respect the constitutional tradition of due process when considering further passport legislation. The Federation of American Scientists, which had assisted Dayton in the preparation of his case, also released a statement expressing gratification and reminding Congress to frame any new statute with regard for the principle that the right to travel is guaranteed by the Constitution.

Sputnik III Signal Recording

The Soviet Embassy in Washington has issued a request for sputnik signal recordings from foreign observers. The embassy's statement, which includes information about the satellite's radio transmission, says:

"The sputnik continues to transmit scientific information. Its Mayak radio transmitter, emitting telegraphic signals on a frequency of 20.005 megacycles, is operating normally. It is being powered by solar batteries, and by electrochemical batteries when the sputnik is moving in the earth's shadow.

"By changing the length of the telegraphic signals, information is being transmitted about the operation of the solar batteries and the quantity of cosmic particles and photons. The signals have been coded as follows: When the radio transmitter is fed by the solar batteries, the length of the first telegraphic signal which follows the marker, equal to 300 milliseconds, lasts 150 milliseconds. When the radio transmitter is being powered by the electrochemical batteries, it lasts 50 milliseconds.

"Recordings of the luminescent cosmic ray counter are transmitted by an alteration in the length of the second and third (the last) signals from 150 milliseconds to 100 or 50 milliseconds. The shift to the various lengths of signals, depending on the number of particles registered, is effected by a relay system. The intensity of the cosmic rays measured is determined by frequency changes in the signals.

"The results of the decoding of the recordings received from the Mayak transmitter indicate that the solar batteries and the cosmic particle and photon counters are functioning normally. The transmitter may be expected to continue functioning for some time unless the solar batteries are put out of commission by meteoric erosion.

"The data transmitted by the Mayak through its radio channel will be of great scientific value if they are registered over a long period of time and by many observers. That is why it is particularly important for the study of the variations of cosmic radiation and the distribution of cosmic particles along the energy scale that the recordings be located in time as precisely as possible (to within a few seconds), that they be continuous, and that the information received about the operation of the cosmic particle and photon counters be received from the maximum number of localities situated in the various latitudes.

"Data on cosmic rays during the time the sputnik is in the earth's shadow are of particular value. The most favorable conditions for such observations at present are in the Southern Hemisphere—the Antarctic, Australia, South America, and South Africa.

"The U.S.S.R. Academy of Sciences would be very grateful to Soviet and foreign scientists and observers for magnetic or photographic plate recordings of the signals emitted by the Mayak transmitter with a specification of the time or a deciphering of these plates. Such information should be addressed to: Sputnik, Moscow."

British Scientists Petition Prime Minister

A group of 618 British scientists presented an appeal on 2 May to British Prime Minister Harold Macmillan, urging immediate action to halt the testing of nuclear weapons. The signers included 69 fellows of the Royal Society and 93 professors of science and medicine at British universities. Nobel Prize winner Sir John Boyd Orr; Sir Charles Darwin, former director of the British National Physical Laboratory; and Julian Huxley, who is former director of UNESCO, were among the signers.

The appeal said:

"Each added amount of radiation causes damage to the health of human beings all over the world and causes damage to the pool of human germ plasm such as to lead to an increase in the number of seriously defective children that will be born in future generations."

In a letter to the Prime Minister accompanying the appeal, Bertrand Russell wrote:

"I hope that this appeal from those most qualified to judge will be carefully considered by you together with the fact that a large majority of the British people are in favor of the suspension of the British tests. May I add that I personally feel that it is intolerable that Britain should continue its present series of tests, despite the suspension by the Soviet Government. A unique opportunity now exists to reduce the nuclear peril which confronts us all. I hope that you and your Government will accept the opinion not only of the many eminent scientists but of millions of ordinary people and call an immediate halt to the present series at Christmas Island."

Macmillan replied in a letter to Russell which rejected the appeal and said that it was essential "to rely upon the nuclear deterrent in order to prevent aggression." He continued:

"It must never be forgotten that the whole purpose of our policy is to save countless millions from death and suffering. This must be balanced against the possible future hazards associated with nuclear tests."

The preceding statements appeared in the May *Newsletter* of the Society for Social Responsibility in Science, which ended its report by observing:

"Shortly after this [exchange], it was announced that the British H-bomb tests at Christmas Island in the Pacific had unexpectedly been cancelled after the first of three scheduled blasts. The reason was not stated."

Jane Coffin Childs Memorial Fund for Medical Research

The Jane Coffin Childs Memorial Fund for Medical Research of New Haven, Connecticut, has announced appropriations totaling $312,779.93 in support of research and fellowships in cancer for the year 1 July 1957–30 June 1958. This brings to slightly over $4 million the total distributed by the fund since its establishment in 1937, when it represented the largest capital investment ever dedicated to the search for the causes of cancer. (Now, 20 years later, $4 million is approximately the sum spent in one year by a single institution, the Sloan-Kettering Institute for Cancer Research; the National Cancer Institute, which for 1958 received an appropriation of $56,402,000, allocated to research grants alone $22,675,000.)

Support is given for research in both the basic and clinical sciences; for postdoctoral fellowships providing advanced research training; for conferences, meetings of national and international societies concerned with cancer research. Among publications to the support of which the fund has contributed since it helped to establish them are the journal *Cancer Research* and the *Atlas of Tumor Pathology*.

Appropriations are voted by the fund's Board of Managers on recommendation of the fund's Board of Scientific Advisers. Directed by M. C. Winternitz, this board includes Edward A. Doisy, Charles B. Huggins, John J. Morton, Thomas Francis, Jr., Richard E. Shope, C. N. H. Long, William U. Gardner; and Levin L. Waters, assistant director. R. G. Harrison, Rudolph J. Anderson, S. Bayne-Jones, and Peyton Ross, members of the original board in 1937, now serve in an honorary capacity.

England, France, Austria, Japan, and Sweden are represented on the list of grants active in 1958. Bengt E. G. V. Sylven, associate professor of experimental cancer research at the Karolinska Institute in Stockholm, received a first grant ($30,000 for 3 years) to develop cytochemical methods to be applied to the problem of how proteolytic enzymes in malignant cells affect surrounding tissues. Jacques Monod, director of the department of cellular biochemistry at the Pasteur Institute, received a fifth grant (totaling $29,400 since 1954) for studies of specific enzymes involved in the selective penetration of certain organic molecules into bacterial cells. Monod has been invited to summarize this work at Harvard University, where he is to give the Dunham lectures this fall. Grants made to the Institute of Cancer Research in London's Royal Cancer Hospital, beginning 1938, when the late Sir Ernest Kennaway, at that time director of the institute, visited the Fund in New Haven, totaled $73,500 in 1958.

American investigators supported by the fund's grants in 1958 were working chiefly in university and medical school departments of the basic and clinical sciences. Six, however, were located outside the schools in nonprofit research institutes, three of which were devoted entirely to cancer.

First grants were made to ten investigators for periods ranging from 1 to 3 years. The other 16 grants active in 1958 represented renewals, some for the tenth to the fourteenth time, bringing support to some of these individuals and groups for twenty consecutive years. These include grants since 1938 for the study of the role of viruses in the genesis of cancer by the late Francisco Duran-Reynals at Yale University's medical school. Among several long-term programs currently supported on the basis of 5-year grants ($25,000 a year) is that of Charles B. Huggins and his associates at the Ben May Laboratory of Cancer Research, University of Chicago.

Biochemical approaches outnumber all others in the work of both investigators and fellows supported by the fund, with especial concern shown for the chemical reactions in normal and neoplastic cells and tissues and with particular interest in protein and nucleoprotein metabolism. Tumor and other viruses, immunological mechanisms, and steroid hormones are being investigated. Studies of steroid hormones range from synthesis in normal tissues to investigation of their role in the metabolism and growth of tumor cells, from use in experimental induction of tumors to use in the treatment of cancer in man.

Relevance to cancer is more broadly assessed in the award of postdoctoral fellowships, in which the primary emphasis is placed on providing training and research opportunities to promising candidates who intend to devote themselves to research. Such fellowships, given for 1 year and in some instances renewed for a second, have taken American and foreign students in a wide range of disciplines to major laboratories in the United States, England, France, Belgium, and the Scandinavian countries. The fellowship program has also made its modest contribution to academic medicine since its inception 15 years ago. Now, when the medical schools have for several years suffered from critical shortages of full-time instructors, past fellows of the Jane Coffin Childs Fund are conducting their research as full-time members of 12 university and medical school departments of the basic and clinical sciences; two are directing coordinated teaching programs in cancer; six others are engaged in full-time research outside the schools in nonprofit research institutes.

Applications for research grants and fellowships are reviewed by the Board of Scientific Advisers three times a year at the offices of the Jane Coffin Childs Memorial Fund for Medical Research, 333 Cedar St., New Haven 11, Conn.

International Unit of Enzyme Activity

The Committee on Biological Chemistry of the Division of Chemistry and Chemical Technology, National Academy of Sciences–National Research Council, has undertaken a program of supplying to investigators information regarding commercially available biochemical reagents. As part of the effort to obtain appropriate data for the description of commercially available enzymes, the Subcommittee on Enzymes of the Committee on Biological Chemistry has searched for a suitable general unit to express the activity of enzyme preparations. Such a unit, universally adopted, would permit easy, direct comparison of data obtained in different laboratories. To further this purpose, it was felt desirable that such a unit (i) should not be based on the use of a particular instrument, (ii) should eliminate as much as possible the use of high numbers and decimal points.

After consideration of various possibilities, it was decided to define a unit as 1 μmole of substrate utilized per minute under specified conditions of *p*H and temperature control, and the specific activity as micromoles per minute per milligram of protein—that is, units per milligram of protein. The latter represents 1/100 the activity value given for many enzymes in the literature expressed as moles of a substrate utilized per 100,000 grams of protein. It is in the range 1 to 1000 for the majority of enzymes commonly used.

The above-mentioned unit cannot be used readily in the description of pro-

teases and other enzymes which act on large molecular substrates that possess numerous linkages susceptible to cleavage. However, in some instances—for example, the phosphorylases—the assay of enzyme activity can be given in terms of micromoles of product. In other instances—for example, for proteases—synthetic substrates of low molecular weight are available and are being used by an increasing number of investigators.

The proposed unit has been found acceptable to a number of enzymologists who have been consulted. Several commercial firms concerned with the production and sale of enzymes both in the United States and in Europe concur in the proposal and are now using this unit in their description sheets.

The purpose of this statement is to stimulate a wider use of this enzyme unit where it is suitable, and to invite comments and suggestions regarding other problems in the evaluation of commercially available enzyme preparations. Please write to Efraim Racker, Chairman, Subcommittee on Enzymes of the Committee on Biological Chemistry, National Academy of Sciences–National Research Council, Washington, D.C.

Manual for Isotope Users

An expert panel has completed the first phase of its task of assisting the International Atomic Energy Agency in drawing up health and safety recommendations to govern the packaging, transport, use, and disposal of radioisotopes. At its first series of meetings, which ended 6 June in Vienna, the panel unanimously approved recommendations for a draft "Manual of Safe Practices." A final draft will be considered at another session of the specialists late in August, and the resulting text will be put before the second general conference of IAEA in the latter part of September.

At a later time, the group will take up the task of establishing international standards in this field for adoption by international and national authorities. The panel is made up of ten members, one from each of the ten countries. Gunnar Randers of Norway is chairman, and Forrest Western is the United States representative.

Science Equipment Library

Hofstra College has announced formation of a central library of scientific and engineering equipment for loan to neighboring colleges and high schools for educating future scientists. The equipment pool, believed to be the first of its kind, will make available expensive apparatus that relatively few institutions can afford.

A $25,000 grant from the Esso Education Foundation is financing the beginning of the new library. The grant to Hofstra is part of a special 3-year program under which the Esso Education Foundation will disburse $1.5 million in grants to improve science and engineering education throughout the United States. The program was initiated last summer when the Standard Oil Company (New Jersey) awarded the special fund to the foundation in observance of the company's 75th anniversary.

Fertility Research Laboratory

A fertility research laboratory has been established at the Margaret Sanger Research Bureau, 17 West 16th St., New York, for the purpose of studying the physiology of reproduction and evaluating methods for the control of conception. Special studies on sperm migration, the time required for the sperm to enter the cervix, and other reproductive processes are already under way. More than 70 products that are being used for contraceptive purposes have already been studied and evaluated in the bureau's laboratories. The results will serve as a guide to planned parenthood centers as well as to the consumer on the effectiveness of the various chemical products now on the market.

The work is under the direction of Abraham Stone, director of the bureau, and John MacLeod of Cornell University. Aquiles J. Sobrero has been appointed assistant medical director in charge of research.

News Briefs

India is preparing the first map of Nepal at the request of the Nepalese Government. Indian aircraft are engaged in an aerial survey that already has covered several thousand square miles of Nepal's total area of 54,000 square miles. The project is to be completed by the end of this year.

* * *

The International Commission on Zoological Nomenclature has new headquarters. All friends and correspondents of the commission, and all members of the forthcoming Colloquium on Zoological Nomenclature, are asked to note that correspondence and inquiries should in future be addressed to Mr. R. V. Melville, Assistant Secretary, International Commission on Zoological Nomenclature, 119 Parkway, Gloucester Gate, London, N.W. 1, England.

* * *

The U.S. Department of Agriculture has assured officials of Colorado, Kansas, Oklahoma, New Mexico, and Texas that it is intensifying cooperative work with these states to halt an outbreak of grasshoppers, now developing as the most serious insect threat of recent years. Under existing state-USDA agreements, the Federal Government will bear one-third of the cost of insecticide treatments needed on rangelands, roadsides, and idle land to prevent further invasion of cropland by the grasshoppers.

* * *

A report that appeared recently in the Chinese Communists' official organ *Jenmin Jihpao* (*People's Daily*), says that most of the provinces in the People's Republic of China are making preparations to set up more research institutes and branches of the Chinese Academy of Sciences as centers for local scientific work. Shensi and Chekiang are provinces where such centers have been established in the last 2 months. Four other branches have been established in the cities of Lanchow, Wuhan, Canton, and Sinkiang, and offices have been opened in Shanghai, Nanking, and Kunming.

* * *

Fifty-five percent of the $480 million paid out by the Metropolitan Life Insurance Company last year in death claims was for diseases of the heart and arteries, and about 20 percent for cancer. Together these causes of death accounted for somewhat more than $3 of each $4 paid in claims to beneficiaries. Twenty years ago they accounted for only 52.7 percent of the total.

* * *

A new reactor at the Atomic Energy Commission's Oak Ridge National Laboratory was successfully operated on 29 May at its design power level of 20,000 kilowatts of heat. The reactor, designated the Oak Ridge Research Reactor, has the highest power level of the six reactors in operation at the laboratory. The reactor represents a major engineering advance over previous research reactors of the materials-testing reactor type, since it achieved extremely high neutron fluxes at only a fraction of the cost of previous reactors of this class. The ORR is a prototype for similar reactors that are being built in various parts of the world.

* * *

Tulane University has contracted with the International Cooperation Administration to extend its consultant services to the seven medical schools in Colombia for 3 more years. Under the program five Tulane consultants have each spent 3 months in Colombia discussing mutual problems with their Colombian colleagues. Opportunities have also been extended to Colombian medical doctors interested in academic medicine to come to the United States on fellowships for advanced study, particularly in the basic sciences.

Scientists in the News

LINUS PAULING has resigned as chairman of the division of chemistry and chemical engineering at California Institute of Technology after 21 years in the post. He will continue at the institute as professor of chemistry. Pauling is succeeded in the chairmanship by ERNEST H. SWIFT, a member of the faculty for 38 years. Swift is one of the leading American analytical chemists and is known for the application of physicochemical principles to chemical analysis.

GREGORY PINCUS, director of research at the Worcester Foundation for Experimental Biology, Shrewsbury, Mass., has been awarded the Oliver Bird Prize for 1958, according to announcement by the trustees in London, England. The award—250 pounds and a medal—was for a paper by Pincus on "Fertility Control With Oral Medication" and for "contributions made in the Worcester Foundation for Experimental Biology under his direction to the study of fertility and its control." Pincus gave the Oliver Bird lecture in London last April at the London School of Hygiene and Tropical Medicine.

FRITS ZERNIKE of Groningen University, Groningen, Netherlands, 1953 Nobel Prize winner in physics, ended his 43-year academic career at Groningen with a final lecture on 16 June. Cables were sent from all parts of the world, and a farewell ceremony was attended by many leading Dutch and foreign physicists. Zernike is known for his work in phase-contrast microscopy.

ARTHUR C. COPE, head of the department of chemistry at the Massachusetts Institute of Technology, has been designated by Columbia University as the Charles Frederick Chandler Lecturer and Medalist for 1958. Cope will deliver his lecture and receive the medal at Columbia on the evening of 22 October.

WILLIAM P. FIDLER, has been appointed general secretary of the American Association of University Professors, effective 1 September. He succeeds ROBERT K. CARR, who has been in charge of the association's Washington office during a year's leave of absence from Dartmouth College. Fidler joined the association's staff in June 1956 from the faculty of the University of Alabama, where he taught American literature and English composition for 26 years.

Surgeon General Leroy E. Burney of the Public Health Service has announced two promotions to the rank of assistant surgeon general: M. ALLEN POND, a commissioned officer of the Public Health Service who has been on detail from the PHS to the Office of the Secretary of Health, Education, and Welfare since 1953; and JOHN C. CUTLER, who has been assistant director of the National Institute of Allergy and Infectious Diseases since January 1958. The latter succeeds ARNOLD B. KURLANDER, now deputy chief of the PHS's Bureau of Medical Services.

JEROME CORNFIELD, assistant chief of the biometrics branch, Division of Research Services, National Institutes of Health, has been appointed to two professorships at the Johns Hopkins Medical Institutions, effective 1 July. He is professor and chairman of the department of biostatistics in the School of Hygiene and Public Health, succeeding WILLIAM G. COCHRAN, and is also filling the newly created post of professor of biomathematics in the School of Medicine.

This year's honorary degree recipients include the following:

GORDON W. ALLPORT, professor of psychology at Harvard University, from Boston University.

CARL K. BECKER, deputy field director of the African Inland Mission, from Hahnemann Medical College.

FRANK MACFARLANE BURNET, director of the Walter and Eliza Hall Institute for Medical Research at the Royal Melbourne Hospital, Melbourne, Australia, from Hahnemann Medical College.

JOHN P. HAGEN, director of the U.S. Navy's Project Vanguard, from Boston University.

EUGENE ROOT, vice president of Lockheed Missiles, Sunnyvale, Calif., and general manager of its Missile Systems Division, from the College of the Pacific.

HARDY L. SHIRLEY, dean of the State University College of Forestry at Syracuse University, from the University of Helsinki, Finland.

PAUL A. SIPLE, biogeographer, research and development division, Office of Chief of Staff, War Department, from Boston University.

ALAN T. WATERMAN, director of the National Science Foundation, from American University.

HEINZ HARTMANN, a member of the faculty of the New York Psychoanalytic Institute, has been selected to receive the 1958 Charles Frederick Menninger Award of the American Psychoanalytic Association. The award is being presented in connection with the publication of Hartmann's classical paper on "Ego Psychology and the Problem of Adaptation." This paper was originally published in German in 1939. It appeared in its first English translation in June.

CHARLES B. HUGGINS, professor of urology at the University of Chicago and director of its Ben May Laboratory for Cancer Research, has received the University of London's third Comfort Crookshank Cancer Research Award. The award was conferred on 3 July by Lord Astor of Hever, council chairman of the Middlesex Hospital of the College of Medicine at London in recognition of Huggins' "fundamental contributions to surgery of cancer." A lecture by Huggins followed the presentation. On 7 July Huggins also received the Order of Merit from the president of the German Federal Republic.

ARTHUR A. WACHMANN, professor of practical astrophysics at the University of Hamburg, Germany, has begun a 6-month research program at Fordham University under the auspices of the National Science Foundation. He is participating in an investigation of variable stars in the Cygnus Cloud of the Milky Way. Wachmann is credited with the discovery in 1939 of the first flare star, a type of star that at irregular intervals and in a matter of minutes can increase in brilliance as much as 100 times. In addition, Wachmann also has four new comets to his credit. For each of the latter discoveries he received the James A. Donohoe Medal of the Astronomical Society of the Pacific.

HEINZ L. FRAENKEL-CONRAT of the University of California Virus Laboratory in Berkeley, and WILLIAM A. FOWLER, physicist at the California Institute of Technology, are joint recipients of the first annual California Scientist of the Year award of $5000. The award is sponsored by the California Museum of Science and Industry, Los Angeles.

LYNFERD J. WICKERHAM and CECIL H. VANETTEN, scientists at the Northern Regional Research Laboratory of the U.S. Department of Agriculture's Agricultural Research Service, have received superior service awards. Wickerham was honored for his pioneering work on the biology of yeasts. VanEtten was recognized for resourcefulness in developing and applying methods of microanalysis to research on antibiotics, dextran, alkaloids, starch derivatives, paints, plastics, and other products made from agricultural commodities.

The American Nuclear Society has announced the establishment of an annual graduate student award in memory of MARK M. MILLS, former associate director of the Livermore Laboratory of the University of California Radiation Laboratory. Mills was killed in a helicopter accident on 7 April at the Eniwetok Proving Grounds.

JOHN C. NUNEMAKER, director of the education service in the Veterans Administration department of medicine and surgery in Washington, D.C., will leave the administration on 1 August to become associate secretary of the American Medical Association's Council on Medical Education and Hospitals in Chicago.

Smith College has announced the retirement of PAULINE BURT, professor of chemistry, and BENJAMIN M. SHAUB, associate professor of geology. Burt joined the faculty as an instructor 40 years ago. Shaub, also known as an ornithologist, went to Smith in 1931.

WILLIAM N. LIPSCOMB, JR., head of the division of physical chemistry at the University of Minnesota, has been selected to receive the 14th annual Harrison Howe Award, sponsored by the Rochester Section of the American Chemical Society. Lipscomb is a specialist in boron hydrides—chemical compounds that are used in fuels for jets and rockets. He will accept the award and present a lecture at a section dinner on 1 November.

JOHN A. KIRCHNER, associate professor of otolaryngology at the Yale University School of Medicine, has received the Harris P. Mosher Award of the American Laryngological, Rhinological, and Otological Society. He was honored for his report that a throat muscle, the cricopharyngeus, has a definite connection to the nervous system and is therefore affected not only by nervous tension but by many neurological diseases.

WILLIAM F. EHRET, professor of chemistry at New York University's Washington Square College of Arts and Science, has received the 1958 Oscar R. Foster Award of the Chemistry Teachers' Club of New York. The award goes each year to a teacher of chemistry "who has over a long period given devoted and noteworthy service."

JOEL WARREN, formerly of the National Institutes of Health, has been appointed director of biologics research at Chas. Pfizer and Company's new facility for biologics research and manufacture at Terre Haute, Ind. KEITH JENSEN, from the virus and rickettsia laboratories of the Public Health Service Communicable Disease Center, is in charge of the section, which is concerned with research on viral agents of the respiratory tract.

ABRAM N. KERNER, chemistry teacher at Stuyvesant High School, New York, has received the first annual $1000 Nichols Foundation Chemistry Teachers Award of the American Chemical Society's New York Section.

PERRY BURGESS, who has been president of the Leonard Wood Memorial for the Eradication of Leprosy since its formation in 1928, retired on 30 June because of ill health. At the annual meeting of the Advisory Medical Board held on 15 February, the following resolution was unanimously adopted:

"The Advisory Medical Board of the Leonard Wood Memorial for the Eradication of Leprosy (American Leprosy Foundation) . . . wishes to record its appreciation of the services which Mr. Burgess has rendered to the Memorial and to the antileprosy movement throughout the world. Mr. Burgess played a dynamic role in the establishment of the Memorial and was largely responsible for the subsequent decision to devote its resources chiefly to scientific research. Through the work of the Memorial, his extensive travels, and his own publications, he has become internationally known for his dedication to the task. . . ."

HAROLD R. WANLESS, professor of geology at the University of Illinois, will spend the next 9 months in Australia on a senior Fulbright research fellowship. He will study Australian coal measures and carboniferous rocks, including many records of ancient glaciation, in the hope of achieving better understanding of sedimentation of North American coal measures. He also will lecture at the University of Sydney and before various learned societies.

GEORGE M. MOORE, chairman of the department of zoology at the University of New Hampshire, has accepted a Fulbright grant as a lecturer in marine biology at Chulalongkorn University, Bangkok, Thailand. He will arrive there on 5 July.

ROBERT S. SHANKLAND, Ambrose Swasey professor of physics at Case Institute of Technology, has resigned the chairmanship of the physics department after serving for 18 years. He will continue to hold the Swasey chair and will devote all of his time to teaching and research. Effective 1 July the administrative direction of the physics department was assumed by a departmental committee.

WILLIAM MONTAGNA, professor of biology and head of the department at Brown University, has been selected by the Colgate-Palmolive Company to receive an award of $5500 in recognition of his many research contributions in the field of skin and hair biology. Montagna recently has embarked upon a study of the skin of primates. The award will aid Montagna in this research program, which will eventually include almost every known species in the primate class.

PAUL E. HEMKE, a vice president of Rensselaer Polytechnic Institute since 1955 and its provost since 1956, retired on 30 June. He joined the institute in 1935 and was head of its aeronautical engineering department from then till he became dean of the faculty in 1949.

Hemke was graduated from Wesleyan College. He holds an M.A. degree from the University of Chicago and a Ph.D. from Johns Hopkins University. He has taught at the U.S. Naval Academy, Northwestern University, Georgia Institute of Technology, and Case Institute of Technology.

Recent Deaths

JOSEPH B. BRENNAN, Cleveland, Ohio; 66; pioneer in electronics and the processing of metals who worked for 4 years under Thomas A. Edison; inventor of the fabricated plate condenser for the small radio; held 40 patents; 13 June.

SETH E. ELLIOTT, Indianapolis, Ind.; 66; head of the Butler University physics department from 1924 until his retirement in 1956; 14 June.

GORDON F. FERRIS, Palo Alto, Calif.; 65; professor of biology (entomology) at Stanford University, with which he was associated for 46 years; founder of the journal *Microentomology* and author of an eight-part monograph on the sucking lice and of seven volumes of the *Atlas of the Scale Insects of North America*; 21 May.

GEORGE D. HUBBARD, Oberlin, Ohio; 87; professor emeritus of geology and geography at Oberlin College; former president of the Ohio Academy of Science; author of the textbook, *Geography of Europe*; 11 June.

L. A. MEKLER, Queens, N.Y.; 63; consulting engineer in the ceramic metallurgical, and petroleum refining industry; held more than 80 patents; 15 June.

ALFRED E. SHERNDAL, Hudson, N.Y.; 72; retired vice president of Winthrop-Stearns, Inc., Rensselaer; known for his research and the production of a synthetic substitute for quinine in the treatment of malaria; 12 June.

MARGARET STANLEY-BROWN, New Milford, Conn.; 64; New York surgeon and instructor in the department of surgical pathology at Columbia University for 25 years; member of the surgical staff at New Milford Hospital; 12 June.

EDWARD J. STIEGLITZ, Washington, D.C.; 58; specialist in geriatric medicine and high blood pressure; author of *The Second Forty Years*; 12 June.

FRANK H. WARD, Rochester, N.Y.; 81; chairman of the board of Ward's Natural Science Establishment, Inc.; electrical engineer before he joined Ward's; 16 June.

Book Reviews

Microbial Ecology. Seventh Symposium of the Society for General Microbiology, held at the Royal Institution, London, April 1957. Published for the Society by Cambridge University Press, New York, 1957. viii + 388 pp. Illus. + plates. $6.50.

The appearance of a new volume in this distinguished series has always been a noteworthy and gratifying event in microbiology. And so, when it was announced that the symposium would tackle microbial ecology, it became apparent to those who have some comprehension of the status of this subject that the challenge was exceptional and that the outcome would have to be extraordinary to maintain the level to which we have been conditioned by the previous six volumes. That the present volume is out of character is therefore not astonishing; in itself this is a commentary upon the previous symposia, upon the make-up of the present symposium, and upon the status of microbial ecology in relation to modern experimental microbiology.

The unique quality of the earlier volumes is the stimulation that always comes when experts mold facts with imagination and project ideas beyond the reach of immediate experimental verification. To be given an opportunity to witness the insights and reflections of authorities who have thought a great deal about the areas of their competencies is a valued privilege we have come to expect of these symposia. This is microbiology at the conceptual level, an all-too-uncommon approach. In *Microbial Ecology* this flavor is substantially less in evidence—in part a consequence of the intrinsic difficulty of coming to grips with the essence of the concept implicit in the title.

However, the chief and fatal weakness of this effort is the assemblage of authors, the majority of whom had no message to deliver. Topics may even be of secondary importance in an affair of this kind so long as the organizers insure that its cardinal function—to unloose a flow of ideas—is fulfilled. The program of the present symposium can perhaps be explained in large part by the availability of the particular participants.

There are, though, some exceptions that are rewarding highlights; for example, F. C. Bawden on plant hosts and G. S. Wilson on aspects of virulence for animals are original, provocative, and scholarly essays after the classic manner. The same holds for the chapter on visible light and microorganisms by R. Y. Stanier and Germaine Cohen-Bazire, carried off with characteristic Stanierian virtuosity. These might well be required reading for graduate students in all branches of microbiology.

The remaining chapters deal, respectively, with the genome, nutrition, hydrogen ion and oxidation-reduction potentials, pressure and temperature, antibiotic production, osmotic pressure, bacteriophagy, predacious fungi, survival of fungi, protozoa, some cellulose-decomposing bacteria, man and animals as hosts, survival and transmission of animal viruses, and arthropod vectors for plant viruses. For the most part these are adequate for the reader seeking a résumé of the current status of the respective topics.

The constitution of "microbial ecology" is a highly subjective matter. Notwithstanding, the essential nature of microbial ecology is grossly misrepresented by the motley assortment of topics here chosen. Moreover, the all-embracing scope has necessarily entailed serious sacrifices. Apart from the strikingly disproportionate emphasis accorded some subjects in relation to others, there is a diffuseness and incohesiveness that derives from a selection of topics that do not lend themselves to integration. This, unfortunately, obscures any central theme and dissipates the impact on the reader, especially on students for whom the previous symposia in this series have been especially instructive and inspiring.

The breadth of subject matter in this volume will be of little consolation to the student and to the average general microbiologist alike, who will be amazed to discover that some of the best-studied habitats of microorganisms, ecologically speaking, such as stagnant ditches and ponds, muds, manure and vegetable matter composts, hot springs, silages, sewage, and the rumen of cattle, are not included.

Difficulties of this kind, and the problem of microbial ecology as a "field" are symptoms of a situation that Charles Dudley Warner had in mind in making the celebrated observation about the weather that is so often attributed to Mark Twain. Microbial ecology has to do with the survival and activities of microorganisms in the exquisitely complex pattern of nature, typically in the context of other microorganisms. Furthermore, the ultimate in microbial ecology is characterized not by environments in nature so extreme as to be unique "ecological niches" but by "normal" conditions where determinant forces are subtle and in dynamic equilibrium. If anything is distinctive about the natural environment of a microorganism, it is the competitive influence of large numbers of other, diverse, microorganisms. In his *Microbiologie du Sol,* Winogradsky's voice was loud and clear in exposing the inadequacies of pure culture methods and laboratory-imposed extremes and the dangers of interpreting microbial phenomena in nature from such information. Yet nowadays, as evidenced by most of the contents of *Microbial Ecology,* these still represent the main approaches to ecological problems. Indeed, it is all too clear that solution of such problems could be furthered greatly if they were approached in the old-fashioned natural history manner *à la* Winogradsky, whereby an accurate description can be obtained of the make-up and the behavior of the mixed populations characteristic of various environments.

This volume, albeit considerably out of focus, has done a service in spotlighting the subject of microbial ecology. We can hope that the embryonic subject of microbial ecology, through the kind of discernment Bawden eloquently reveals on the opening page of his presentation (page 299), will have metamorphosed into a recognizable entity and will be adequately represented when it reappears as the agenda of a symposium of the Society for General Microbiology.

J. W. Foster
Department of Bacteriology, University of Texas, Austin

Sun Circles and Human Hands. The Southeastern Indians—art and industries. Emma Lila Fundaburk and Mary Douglass Fundaburk Foreman, Eds. E. L. Fundaburk, Luverne, Ala., 1957. 232 pp. Illus. $7.50.

This work begins with a competent eight-page summary of the major archeological periods of the southeastern United States, written by Emma Lila Fundaburk. In succeeding chapters are reprinted standard accounts by other authors on various aspects of prehistoric Southeastern art and industries. Each chapter is followed by a set of illustra-

tions, with detailed captions written by Fundaburk or quoted from appropriate technical literature.

The text provides a reliable survey of Southeastern archeology but does not contribute new data or interpretations. The illustrations, however, are exciting even to specialists on the Southeastern Indians. Fundaburk searched for them in a large number of private collections and obscure museums, as well as in the major museums. She found good examples of typical artifacts and many remarkable pieces not previously illustrated or described. The specimens are well identified and scrupulously documented, and the photographs are excellent and clearly reproduced. Perhaps the most remarkable feature of the book is that Fundaburk was entirely unknown to Southeastern archeologists before she began her research for this work. With the appearance of her book she has gained their respect and admiration, not only for the obviously great amount of time and expense it involved but also because of the discernment evident in her interpretations.

A number of audiences will find this book useful. Southeastern archeologists will be particularly pleased with the numerous artifacts described and illustrated for the first time, especially those from Alabama, a state where little serious work in archeology has been done. Amateur archeologists and "Indian relic" collectors will like the large number of illustrations and will learn from the picture captions and the text. Artists and connoisseurs of primitive art now have a good source of Southeastern Indian motifs and designs and a striking demonstration that the prehistoric art of this area often equals better-known styles of primitive art in interest and value in terms of modern Euro-American esthetic tastes. Public and school libraries will find this book to be a reliable and readable addition to their reference works on Indians.

WILLIAM C. STURTEVANT
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Washington, D.C.

Pharmacology in Medicine. A collaborative textbook. Victor A. Drill, Ed. McGraw-Hill, New York, ed. 2, 1958. xi + 1273 pp. $19.50.

This second edition attests the success of multi-authorship in a text on pharmacology. As with internal medicine, the increased scope of the field makes authorship by one or two individuals almost too demanding in comprehensive volumes. In the more than 1200 large pages (the weight of the volume is about five pounds) the burden has been spread among some 85 authors, most of them senior professors of pharmacology. The result is an excellent and detailed coverage of the field.

The type is clear and pleasant; there are two columns to the page for easier reading; and tables, structural formulas, and pertinent references are plentiful. The book will have appeal both to workers in pharmacology and to many others who seek readable presentations in specific areas.

WINDSOR CUTTING
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Exploring the Atmosphere's First Mile. vol. I, *Instrumentation and Data Evaluation*; vol. II, *Site Description and Data Tabulation.* Proceedings of the Great Plains Turbulence Field Program, 1 August to 8 September 1953, O'Neill, Nebraska. Heinz H. Lettau and Ben Davidson, Eds. Pergamon Press, New York and London, 1957. xiv + 578 pp. Illus. 2 vols., $20.

In the summer of 1953, meteorologists from ten universities and five government laboratories joined in the Great Plains Turbulence Field Program, the most intensive observing program to which the atmosphere has ever been subjected. An area near O'Neill, Nebraska, was chosen for the program. This area is said to be the flattest site in the flattest state in the flattest region of the United States. Lettau and Davidson, the leaders of the program, have edited this report, which has been written by about thirty-five of the participating scientists. The purpose was to describe the state of the lower part of the atmosphere in sufficient detail to make possible accurate calculations of turbulent transfer of heat, momentum, water vapor, and other gases and pollutants. The ultimate purpose was to achieve an accurate theory of atmospheric turbulence which would provide explicit data on the dependence of evaporation on wind speed, radiation, and the nature of the surface; which would express the warming or cooling of the air in terms of similar factors; which would specify the characteristics of the turbulent motions by the static stability and the configuration of the boundary, and so on.

Volume 1 contains accounts of the synoptic observing program, subsoil measurements, interface measurements, mast profile observations, fluctuation quantities, and free-air observations, plus a general introduction and a summary of some of the results of calculation. Volume 2 contains summaries of the data taken in seven observation periods totaling 171 hours. Additional data are on file at the Geophysical Research Directorate and at the cooperating universities. Many of the participating scientists have been working since 1953 in reducing the data and in applying the results to theory. Testing of theories will be greatly facilitated by publication, and we may expect these volumes to be exploited like a productive gold mine for years.

The most dramatic achievement of the program was the discovery of the low-level jet, a high-speed layer of air that is observed at night at a height of about 500 meters above the ground. This discovery has stimulated wide discussion, and Blackadar and Buajitti have been able to explain the phenomenon as an inertial oscillation resulting from diurnal changes in eddy viscosity.

Another development of great interest was the field testing of the sonic anemometer, applied to the problem of direct measurement of turbulent heat transfer.

The part of the program which lay at the heart of the undertaking—observations of vertical profiles of wind, temperature, and humidity—has been somewhat disappointing. Although observations were made on a much more intensive scale than ever before, the calculations reflect the same stubborn sources of error, and the various independent methods of calculating evaporation and heat transfer do not agree as closely as had been hoped. The profiles of vapor pressure are particularly unreliable.

A second field program, designed to measure directly the diffusion of gas and to relate these measurements to profiles of wind, temperature, and humidity, was carried out during the summer of 1956 at the same location. The report of this program is not yet available.

ROBERT G. FLEAGLE
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General Diagnosis and Therapy of Skin Diseases. An introduction to dermatology for students and physicians. Hermann Werner Siemens. Translated from the German by Kurt Wiener. University of Chicago Press, Chicago, 1958. vii + 324 pp. Illus. $10.

The author's method of introducing dermatology to students and physicians is as revolutionary as would be the case if modern pedagogy returned to syllabication as an aid in the teaching of spelling, rather than insisting on an initial grasp of each word as a whole. Through the medium of close-up photography Siemens has made a unique presentation of the elements that must be observed and understood in order to diagnose and treat diseases of the skin. Each minute

change in the gross pathology has not only been clearly described but has also been illustrated by black-and-white photographs of a quality surpassing that of the average color photograph.

Siemens planned a new method of presentation of clinical dermatology, outlined the work in detail, and then carefully sought clinical material to illustrate each point. The continuous cooperation and contributions, over a 25-year period, of an excellent clinical photographer, J. J. van der Walle, made it possible to record photographically the necessary close-up detail from clinical material as it became available, rather than comb files later for the best existing photographs or borrow extensively from colleagues' collections. There are 398 photographs and 15 drawings that illustrate the detail in individual lesions and the grouping, nuances, and modifications of lesions during the course of disease.

Not only is Siemens' approach to diagnosis different because of his emphasis on detail but his handling of therapy is also unique, because of his emphasis on the need for reaching a maximal dosage in each case in order to guard against later recurrence. The application of this concept has previously been limited to anthralin and a few other medicaments. Combination of experimental method with the usual pragmatic approach is advocated by the author in handling each patient. He includes a finely detailed description of reactions to treatment.

Hermann Werner Siemens is professor of dermatology and venereology at the University of Leiden, Holland. His book has been ably translated into English by Kurt Wiener of Milwaukee, Wisconsin, at a time of reawakened interest in dermatological morphology.

LEON H. WARREN
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Parke, Davis and Company

Gmelins Handbuch der Anorganischen Chemie. *Systematik der Sachverhalte,* 1957, $17.28; system No. 28: *Calcium,* pt. B, sec. 2, 1957, xvi + 391 pp., illus., $52.56; system No. 60: *Kupfer,* pt. B, sec. 1, 1958, xxvii + 624 pp., illus., $83.76. Verlag Chemie, Weinheim/Bergstrasse, Germany.

The *Systematik der Sachverhalte,* or systematic subject-matter index, in which the entries are given in both English and German, gives the basis underlying the arrangement of material in the *Gmelin Handbook.* The terms used were developed over a period of more than thirty years of working on the eighth edition of the *Handbook.*

The index serves as a classification guide to the scientific archives of the Gmelin Institute and contains all the subject headings used in classifying the material falling within the scope of the Gmelin literature coverage.

The volume on calcium contains the descriptions of compounds of calcium with hydrogen, deuterium, oxygen, nitrogen, fluorine, chlorine, bromine, and iodine and of compounds of those compounds with sulfur, up to the item dithionite. Detailed accounts are given of methods of preparation as well as data on chemical properties and behavior and various physical properties. The literature is covered to 1949.

The volume on copper is similar in nature to that on calcium. It considers the compounds of copper with the same combining elements but, in addition, includes compounds of copper with selenium and tellurium. The items go as far as copper tellurate. The literature is covered to 1949 and, in some cases, to 1954.

RALEIGH GILCHRIST
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Integral Equations. And their applications to certain problems in mechanics, mathematical physics and technology. S. G. Mikhlin. Translated from the Russian by A. H. Armstrong. Pergamon Press, New York and London, 1957. xii + 338 pp. $12.50.

The translator has done his best, and on the whole he has done it well. However one sympathizes with him when he asks the reader's indulgence for inadvertent errors in the translation, particularly for any misspelling of proper names, incorrectly transliterated back to their native alphabet. Such a confession of ignorance casts a poor reflection on the publishers of a series on pure and applied mathematics, who could surely have found someone to do the necessary checking. A good mathematical book, whatever its topic, is a work of art, not to be mutilated by poor spelling of mathematicians' names.

It is true that this book in no way attempts to be a work of art. It is strictly practical in its object and outlook, and it is for strictly practical reasons that the gaps in the intuitive theory of the first edition have been filled, so that this theory now has the standard L_2 background, although it makes no attempt to go beyond this. However, it is still a good book. Its heart lies in the applications, which constitute 60 percent of the subject matter and are extremely detailed. The author doubtless feels, and there is much to support this view, that the right way to study integral equations is to go in great detail into their applications—into the Dirichlet problem, potential theory, the biharmonic equation, and the like. This approach goes a long way in making up for the lack of fire in the somewhat uninspired and standardized treatment of the theory. It is a book, in brief, from which the reader is likely to gain very valuable insight into the connections with older problems of analysis and mathematical physics and which will make him want to study further the connections with newer trains of thought.

L. C. YOUNG
Department of Mathematics,
University of Wisconsin

Handbuch der Physik. vol. XVI, *Electric Fields and Waves.* S. Flügge, Ed. Springer, Berlin, 1958. vii + 753 pp. Illus. DM. 158.

This volume contains five articles. The first one, "Static fields and stationary currents," by G. Wendt, treats the theory of electrostatic and magnetostatic fields of charges and currents. General theory as well as analytical, numerical, graphical, and experimental methods of solving field problems are covered. Many interesting and useful problems are solved, extensive use being made, for instance, of the Schwarz-Christoffel transformation.

The second article, "Quasi-stationary and non-stationary currents," by Ronald King, starts with the essentials of electromagnetic theory. Then follow coupled systems and transmission line and antenna theory. Many examples are worked out, including loop antennas, both shielded and unshielded.

The third article, "Electromagnetic wave guides and cavity resonators," by F. E. Borgnis and C. H. Papas, treats transmission line analogy, cylindrical and miscellaneous wave guides, slow wave and wave-guiding structures, wave-guide junctions, and cavity resonators. In the words of the authors, this was written for the reader who needs to acquire sufficient theoretical background to read pertinent research literature.

The fourth article, "The propagations of electromagnetic waves," by H. Bremmer, treats the propagation of electromagnetic waves through free space and includes an extensive treatment of antenna theory, including focusing of antenna radiation by lenses and mirrors, and the transmission of electromagnetic waves through curved atmospheres, with particular reference to transmission and diffraction phenomena in the earth's atmosphere.

The fifth article, "The dispersion and absorption of electromagnetic waves," by L. Hartshorn and J. A. Saxton, treats the experimental methods for the study of the behavior of matter under the action of electromagnetic waves of length greater than a few millimeters. This includes low- and high-frequency measure-

ments and free wave and wave-guide methods. The last section is devoted to actual experimental results for typical dielectric materials.

These articles have been written in such a way as to be clear and intelligible and, at the same time, contain as many of the important developments as possible. Extensive references and bibliography are given. This volume should be indispensable as a reference book in this field as well as valuable for anyone wishing to obtain quickly a knowledge of any of the subjects treated.

EDWARD S. AKELEY
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New Books

The Strangest Things in the World. A book about extraordinary manifestations of nature. Thomas R. Henry. Public Affairs Press, Washington, D.C., 1958. 208 pp. $3.50.

Current Studies in Psychology. F. J. McGuigan and Allen D. Calvin. Appleton-Century-Crofts, New York, 1958, 226 pp. $2.65.

The Living Body. A text in human physiology. Charles Herbert Best and Norman Burke Taylor. Holt, New York, ed. 4, 1958. 767 pp. $6.95.

Introduction to Electromagnetic Engineering. Roger F. Harrington. McGraw-Hill, New York, 1958. 324 pp. $8.

Mathematical Theory of Compressible Fluid Flow. Richard von Mises; completed by Hilda Geiringer and G. S. S. Ludford. Academic Press, New York, 1958. 527 pp. $15.

Directed Studies in Introductory College Geography. George T. Renner and Hugh C. Brooks. Appleton-Century-Crofts, New York, 1958. 167 pp. $2.36.

Elementary Practical Organic Chemistry. pt. III, *Quantitative Organic Analysis.* Arthur I. Vogel. Longmans, Green, New York, 1958. 240 pp. $4.50.

Essentials of College Geography. C. Langdon White, George T. Renner, Robert T. Novak. Appleton-Century-Crofts, New York, 1958. 588 pp. $6.

Glaucoma. Transactions of the second conference 3–5 Dec. 1956, Princeton, N.J. Frank W. Newall, Ed. Josiah Macy, Jr. Foundation, New York, 1958. 245 pp. $4.95.

College Chemistry. Paul R. Frey. Prentice-Hall, Englewood Cliffs, N.J., ed. 2, 1958. 751 pp. $6.95.

The Exploration of Space by Radio. R. Hanbury Brown and A. C. B. Lovell. Wiley, New York, 1958. 219 pp. $6.50.

Chemical Publications, Their Nature and Use. M. G. Mellon. McGraw-Hill, New York, ed. 3, 1958. 337 pp. $7.

Bird Hybrids. A check-list with bibliography. Tech. Commun. No. 13. Annie P. Gray. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England, 1958. 400 pp. 50s.

The Russian Literature of Satellites. pt. I. International Physical Index, New York, 1958. 181 pp. $10.

The Garden of Chaparral. Plants of the lower Rio Grande Valley. Elizabeth M. Riess. Vantage, New York, 1958. 158 pp. $3.

Interdisciplinary Team Research: Methods and Problems. No. 3 of the Research Training Series. Margaret Barron Luszki. New York Univ. Press (for the National Training Laboratories), New York, 1958. 382 pp. $6.

Applied Mathematics for Engineers and Physicists. Louis A. Pipes. McGraw-Hill, New York, ed. 2, 1958. 734 pp. $8.75.

Concepts of Classical Optics. John Strong. Freeman, San Francisco, 1958. 708 pp. $9.50.

Energy for Man. Windmills to nuclear power. Hans Thirring. Indiana Univ. Press, Bloomington, 1958. 409 pp. $6.95.

Unit Processes in Organic Synthesis. P. H. Groggins. McGraw-Hill, New York, ed. 5, 1958. 1080 pp. $17.50.

Cahiers de Synthèse Organique. vol. IV. Léon Velluz, Ed. Masson, Paris, 1958. 272 pp. Paper, F. 5000; cloth, F. 5500.

Chemical Thermodynamics. A course of study. Frederick T. Wall. Freeman, San Francisco, 1958. 429 pp. $8.

Carbon Dioxide Therapy. A neurophysiological treatment of nervous disorders. L. J. Meduna, Ed. Thomas, Springfield, Ill., ed. 2, 1958. 553 pp.

The Effects of Radiation on Materials. J. J. Harwood, Henry H. Hausner, J. G. Morse, W. G. Rauch. Reinhold, New York; Chapman & Hall, London, 1958. 360 pp. $10.50.

Pregnancy, Birth and Abortion. Paul H. Gebhard, Wardell B. Pomeroy, Clyde E. Martin, Cornelia V. Christenson. Harper, New York, 1958. 295 pp. $6.

Wave Propagation and Antennas. George B. Welch. Van Nostrand, Princeton, N.J., 1958. 265 pp.

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Reports

Neutralization of Common Cold Agents in Volunteers by Pooled Human Globulin

The common cold has been transmitted repeatedly to volunteers by means of filtered nasal secretions (*1, 2*). Whether or not infected persons subsequently develop specific immunity to the common cold agents is not known. Some volunteers who developed a cold after receiving infectious nasal secretions have been observed to be susceptible to the same material at a later instillation. In addition, studies based upon spontaneous infections suggest that patients develop little or no immunity to the clinical common cold syndrome (*3*). Resistance to infection among adults, however, is greater than in children (*4*). Also, in a recent study the administration of vaccine made from a common cold agent isolated in tissue culture was believed to protect the subjects against this infection (*5*).

At the present time information about whether common cold agents elicit an antibody response in human beings and whether such an antibody can neutralize the infectious agents cannot be obtained from laboratory experiments. In the studies reported here (*6*), volunteers were challenged with infectious nasal secretions that frequently caused a common cold to develop, and pooled human gamma globulin was tested for its capacity to neutralize the infection.

Nasal secretions designated as NS142 and NS154, collected in different years from two persons with characteristic common colds, were filtered to remove bacteria and cells and stored at −70°C. In a search for known viruses, aliquots were tested on human epithelial cells, strain HeLa, and monkey kidney cells in tissue culture, in embryonated hens' eggs, and in suckling and adult mice. If no known viruses were found, the infectivity of the secretions was demonstrated by the transmission of an acute, afebrile, coryzal upper respiratory illness to volunteers by the instillation into each nostril of 0.2 ml of a 1:100 dilution of the nasal secretion in Hanks salt solution. Other subjects served as controls.

In each experiment four random matched groups of student nurses were given simultaneously one of the two secretions in one of a variety of diluents or an equal volume of diluent without nasal secretion. Uniform daily observations to detect the development of an experimental common cold were made for one week after the challenge, by an observer who was not informed regarding the nature of the instillation each volunteer had received. The details of the method and characteristics of the illness have been published elsewhere (*1*).

Neutralization of the infectivity of the nasal secretions was tested by incubating one part of a 1:10 dilution of a secretion with nine parts of the appropriate test diluent. The materials tested were pooled human globulin (*7*) in a final concentration of ± 8.0 g percent of protein, boiled human globulin concentrated to ± 12.0 g percent of protein, human serum albumin (*7*), or Hanks salt solution. The mixture was kept for 30 minutes at 37°C; then 0.2 ml was given to each volunteer as nose drops.

The results of seven replicate experiments in which the two different infectious nasal secretions were used with different lots of gamma globulin and human albumin are given in Table 1. The highest percentage of colds, 52 percent, occurred among volunteers challenged with nasal secretion diluted in buffered salt solution. Diluting the nasal secretion with the supernatant from a boiled gamma globulin solution did not alter the percentage of volunteers who developed an experimental cold. Similarly, mixing the nasal secretion in human albumin decreased the percentage of colds only slightly and insignificantly. When the infectious secretions were incubated with pooled human gamma globulin, however, colds were observed in only one-fifth as many subjects as in the two groups just described. Among the control subjects who received gamma globulin or diluent without infectious secretion, an average of 15 percent developed colds. "Spontaneous" colds among noninfected volunteers have been observed during previous experiments in approximately 10 percent of female subjects (*1*).

The distribution of experimental common colds among these groups is statistically highly significant ($p = < .001$). Among the groups inoculated with infectious nasal secretion in saline solution, boiled gamma globulin, or albumin, there was no significant difference. When the secretion was instilled in gamma globulin, the results were highly significantly different from the results with the preceding three vehicles ($p = < .001$) and were statistically similar to the results in the noninfected group. Pooled human gamma globulin was effective in delaying the appearance of symptoms among the volunteers who were not entirely protected. All of the individual symptoms were modified by gamma globulin.

With respect to the duration of the latent period before the onset of symptoms among the volunteers, the two infectious secretions, NS142 and NS154, behaved differently. Also, 90 percent of the symptoms produced by NS154 originated in the upper respiratory tract, whereas nearly 30 percent of those caused by NS142 were from the lower respiratory tree, or systemic symptoms. Paired serum specimens from the volunteers showed no antibody rise for influenza or adenoviruses or, with rare exception, significant neutralization of the new 2060 or J. H. agents (*8*).

The data show that the pooled human

Table 1. Transmission of colds to volunteers.

Challenge inoculum	No. of volunteers	No. with colds	Percent with colds
NS142	21	11	52.4
NS154	44	23	52.3
Subtotal	65	34	52.3
NS142 + boiled gamma globulin	20	11	55
NS154 + human albumin	18	8	44.5
Subtotal	38	19	50
NS142 + gamma globulin	22	3	13.7
NS154 + gamma globulin	37	3	8.1
Subtotal	59	6	10.2
Gamma globulin only	12	0	0
Hanks solution only	49	9	18.3
Subtotal	61	9	14.8

All technical papers are published in this section. Manuscripts should be typed double-spaced and be submitted in duplicate. In length, they should be limited to the equivalent of 1200 words; this includes the space occupied by illustrative or tabular material, references and notes, and the author(s)' name(s) and affiliation(s). Illustrative material should be limited to one table *or* one figure. All explanatory notes, including acknowledgments and authorization for publication, and literature references are to be numbered consecutively, keyed into the text proper, and placed at the end of the article under the heading "References and Notes." For fuller details see "Suggestions to Contributors" in *Science* 125, 16 (4 Jan. 1957).

globulin neutralized both agents and was approximately 65 percent effective in decreasing the mean symptom score caused by either one. Apparently these agents are antigenic in the human being, and they or related agents have caused rather widespread infections and antibody response. Nonspecific inhibition of the infectious agents is a possibility, but other experiments have discounted this (*3*).

One possible explanation of the lack of resistance against the common cold is that circulating antibody can protect against a systemic infection but is of little importance in the prevention of a local infection of the mucous membranes of the upper respiratory tract. We have shown that the common cold in adults is an afebrile and presumably localized respiratory infection (*1*), whereas children have more systemic symptoms. There is some evidence that local infections with other viruses also might occur in the presence of circulating antibody (*9*).

Prior studies in our laboratory have demonstrated that gamma globulin is consistently found in nasal secretions. It is not clear why the antibody is ineffective in the nose. The concentration of specific antibody might be critical, or inhibitory substances might block the antibody effect. Possibly cellular resistance is independent of antibody. Finally, antigenic variants of the agents that cause common colds might produce recurrent infection.

The demonstration of protective antibodies against the common cold in human gamma globulin is noteworthy with respect to the problem of immunity and immunization against this illness. Further exploration of some of the factors discussed is necessary before it will be known whether it is feasible to protect against common colds by the administration of vaccines.

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7. The solution of pooled human plasma proteins was kindly furnished by Lederle Laboratories Division of the American Cyanamid Co., Pearl River, N. Y., and by Armour Laboratories, Chicago, Ill.
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6 March 1958

In vitro Decomposition of 1-Adrenochrome

1-Adrenochrome has been reported to produce psychotomimetic effects following intravenous injection (*1, 2*), and it has also been reported to be markedly elevated in the blood of normal subjects receiving lysergic acid diethylamide (*3*). In view of the reported instability of adrenochrome (*2, 4*) in the solid state and in solution prior to its injection, a study of the variables affecting decomposition was made (*5*).

1-Adrenochrome (*6*) was prepared as follows: To 176.5 mg of synthetic 1-epinephrine in 5 ml of redistilled methanol there was added 0.1 ml of 98-percent formic acid. One gram of freshly prepared silver oxide was added, with stirring. A deep red color developed immediately, and the temperature rose to 42°C. The reaction mixture was stirred for 2 minutes and centrifuged at high speed, and the supernatant solution was allowed to stand at −20°C for ½ hour. The precipitate was filtered and washed with a small volume of cold methanol-ether (1:1) followed by methanol-ether (1:3) and, finally, with ether to remove all traces of methanol. The yield of 1-adrenochrome was 54.3 mg (32.5 percent).

The absorption spectra showed three maxima, at λ-220, λ-300, and λ-480 mμ. The 480-mμ peak was used to follow the decomposition of 1-adrenochrome in 0.9-percent saline (*p*H 7.0), redistilled water (*p*H 7.0), and methanol solutions. It was found that the stability at room temperature (22°C) was greatest in sodium chloride solution and least in methanol solution. The decomposition was approximately 2.5 percent in saline, 5 percent in water, and 10 percent in methanol in 12 hours in the concentration range of 15 to 25 μg/ml and was approximately proportional to the time for at least 48 hours. It also was found that concentration affected the rate of decomposition. Thus, in saline solution, 3.8 mg of 1-adrenochrome per milliliter decomposed to the extent of 34 percent in 12 hours at room temperature, whereas, at 3.4 μg/ml, decomposition was not measurable even after 96 hours. Temperature also affected the decomposition. A solution of 1.9 mg of 1-adrenochrome per milliliter in 0.9-percent sodium chloride solution decomposed to the extent of more than 60 percent in 24 hours at room temperature but only to the extent of 4 percent at 3°C or at −20°C. The *p*H is also an important variable. Zambotti and Moret (*7*) reported that in 0.9-percent saline solution at 37°C in 2 hours there was a loss of 25 percent at *p*H 5.91 and of 90 percent at *p*H 7.38.

The decomposition of 1-adrenochrome in the solid state stored for 3 months at room temperature in an ordinary capped glass vial was also studied. No changes were observed in the infrared spectra obtained in the solid state in a potassium bromide pellet. The spectrum of the 1-adrenochrome synthesized by the method described was identical in all respects with the spectrum of a sample of 1-adrenochrome synthesized by the method of Sobotka and Austin (*8*), which was obtained from the Research Division of Armour and Co.

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3 February 1958

Cytochemical Demonstration of Masked Lipids

There are several methods for the cytochemical or histochemical *in situ* demonstration of free lipids, or of lipids which give general or special color reactions (*1*). However, the larger fraction of lipids in ordinary cells (excluding fat cells or similar tissues) belongs to the class of, until now, cytochemically nondemonstrable or masked lipids, which should form lipoprotein complexes or complexes of a higher order. For instance, in calf-liver cells it has been possible, by extraction with suitable salt

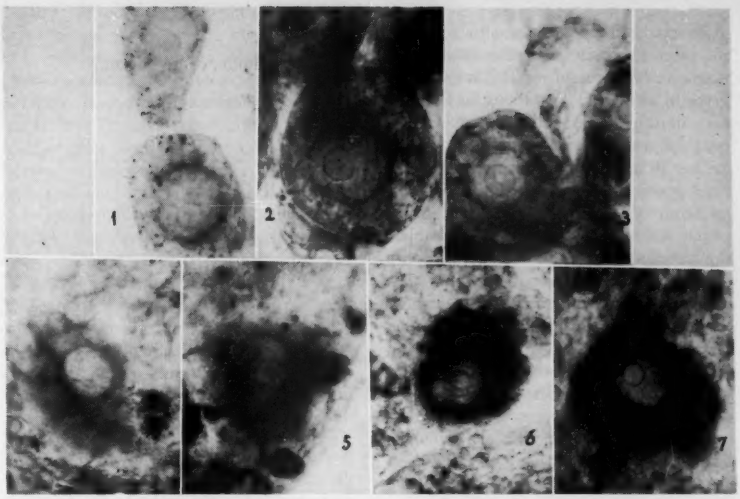
solutions, to prepare "ghost cells" which are almost exclusively composed of lipoproteins and whose aspect, nevertheless, is almost unchanged in comparison with the intact, original cells (*2*).

We present here a method for the demonstration of masked lipids *in situ* which has given us good results in the study of these compounds in the cell. The method may be quantized in the future by coupling it with lipid extraction and with determination of concentration by optical means. The latter procedure alone—that is, mass determination by absorption (soft x-rays) or interferometry and refractometry, coupled with extraction—is capable of giving an idea of the quantity of total lipids or of certain classes of these compounds, but it suffers not only from the errors of unspecific and incomplete extraction but also from those derived from differences in the optical properties of the protoplasm before and after extraction. As a result of such errors, these procedures do not generally allow of a fine location of the compounds in the cell structures (for instance, within the nucleolus), while valid cytochemical *in situ* methods, of the specific-coloration or colored-end-product type, necessarily give such details. Moreover, cytochemical *in situ* methods generally are much more sensitive than mass determinations.

The method is based essentially on the finding of a specific coloration for lipids, after suitable fixation, coupled with an incipient separation of the protein from the lipid in the complexes by means of reagents which mildly attack the protein and not the lipid. Concentrations of these attacking or demasking reagents are employed which give a separation of lipids sufficient for their taking up of the specific dye but which do not dissolve the protein and thus distort the microscopic structure of the cell. Finer location and control of the cell structures in the course of the reaction would be possible if an electron microscope and suitable lipid "electron dyes" were used.

The results are appraised by comparing the aspects of cells colored with and without the demasking reagent and by extracting the lipids and coloring afterwards.

Fixation and coloration may be carried out apart, but it was found to be more convenient to perform both simultaneously, and together with the demasking. A layer of 10 ml of absolute alcohol saturated with Sudan black is carefully poured into a graduated cylinder, over an equal volume of Baker's (*3*) fixative-preserving solution for lipids [consisting of a mixture of 10 ml each of 40-percent formalin, 10-percent calcium chloride (anhydrous), and 10-percent cadmium chloride, and 70 ml of distilled water]. These are mixed at once by shaking and



Results obtained by means of fixation, coloration, and demasking, with Sudan black. Figs. 1, 2, and 3: root tips of *Vicia faba*; Figs. 4, 5, 6, and 7: oocytes of the snail *Cepaea nemoralis*. Figs. 1 and 4 show results when no demasking reagent was used; Figs. 2 and 5 show results when barium hydroxide was used as the demasking reagent; Figs. 3 and 7 show results when urea was used; and Fig. 6 shows results when a mixture of barium hydroxide and urea was used. Differences in coloration of the cytoplasm and the nucleus, especially apparent in the nucleolus in *Vicia*, are seen on comparing Figs. 1 and 4 with those that show results of using preparations that contained a demasking reagent. (Figs. 1, 2, and 3, about × 890; Figs. 4, 6, and 7, about × 200; Fig. 5, about × 310.)

are filtered through rapid-filtering filter paper, or simply through cotton wool. The demasking compound is now added to an aliquot of the filtrate, and this is immediately used (otherwise the Sudan black colloidal solution may settle). Coloration, carried out in small stoppered test tubes, is obtained in about 18 to 48 hours, a mean time of 24 to 36 hours at 20°C generally giving good preparations.

It should be remarked that the pieces to be fixed should consist of a small number of cell layers, preferably sections (obtained free-hand or with the freezing microtome); otherwise uneven penetration of the colloidal dye results.

We found that barium hydroxide (obtained from the solid form that is sold in small lumps) and urea give good results. Other compounds or reagents which denaturate or slightly attack proteins may also be employed. To 1 ml of the filtrate is added about 25 mg of solid, freshly powdered barium hydroxide, or 50 to 200 mg of crystallized urea. Several concentrations and the mixture of both compounds were tried, and it was found that, according to the tissues, urea should be added in lower or higher concentration—lower for animal tissue, higher for plant tissue; the mean concentration here recommended for general purposes is 0.1 g/ml.

Parallel colorations were made on similar sections (i) after a thorough lipid extraction (which may be a selective extraction, only for certain classes of lipids) and (ii) with and without the demasking compound having been added to the fixing-coloring filtrate. Extraction errors excepted, the differences between preparations with and without extraction give the total lipids. Differences between preparations to which the demasking reagent has been added and those to which it has not been added give the masked lipids; it is to be noted, however, that the 50-percent alcohol and the cadmium salt in the fixing-coloring mixture also effect some demasking, though only a mild one. Nonspecific colorations, or impregnations, produced as a result of the long coloration time are appraised by comparing the sections which underwent extraction with those which did not undergo extraction or demasking.

Figures 1 to 7 give an idea of the results of this method; they show some aspects of plant and animal cells stained both with and without the action of demasking reagents. Differences are conspicuous in the nucleus and in the cytoplasm.

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24 January 1958

Sibling Patterns in Schizophrenia

It has been hypothesized that siblings in different positions within the family constellation are subject to varying degrees of stress (*1, 2*). Owing to this factor, the first-born sibling is not infrequently presented as having significantly greater difficulties in adjustment than the later born (*3*). Since stress is believed to be an etiological variable in schizophrenia, attempts were made to establish the existence of a definite relationship between sibling position (especially that of the first-born) and the incidence of this disease in a large sample (*1*). This relationship has, however, never been satisfactorily established (*4*). In the majority of studies, families of all sizes, as well as families that are most probably incomplete—containing other psychotic siblings, siblings who have died, and so on—are included in the samples. Thus, the conclusions lack consistency, in part at least, because of shortcomings in statistical design or analysis (*5*). An attempt was made in the study discussed in this report to investigate the hypothesized relationship between sibling position and incidence of schizophrenia in such a way as to minimize the errors mentioned.

The data were collected during 1955 and 1956 at Warren State Hospital, Warren, Pennsylvania. The cases studied were restricted to schizophrenic patients with two normal siblings and were drawn from the following sources: the files of such patients present in the hospital for more than 2 years and the files of such patients discharged over a period of 15 years. The information recorded in each file included the age and the sex of the patient and of his siblings, so that ordinal position by sex could be determined. Families containing adopted children or stepchildren, twins, triplets, or siblings who had also been hospitalized for any mental disease were rejected. Also excluded were cases in which a sibling had died before the patient reached his 20th year, or in which the clinical diagnosis was primarily of mental deficiency or organic central nervous system disease. To insure inclusion of only completed families, only those cases were approved in which the youngest sibling was over 10 years of age.

These conditions were set in the hope that, if there were an ordinal positional effect, it would be most clearly demonstrated where only one of the three siblings developed schizophrenia. Patients with only two siblings were selected in order to limit and define ordinal positional effects and also to facilitate the evaluation of the role of the sex of the patient and siblings in the constellation.

Table 1 summarizes sibling constellations and sex distribution of 156 cases which met all criteria. Since, during the period covered by this study, the male first-admission rate to mental hospitals for schizophrenia was generally 15 percent lower than the female rate, an appropriate correction factor for sex incidence was introduced. Approximate expectancies for the case distribution, by sibling, were calculated for each constellation. The results are summarized in Table 2.

Chi-square tests were carried out for each constellation that appeared to depart substantially from expectation. None of these tests indicated statistically significant departures from expected incidence rates—that is, no ordinal position appears to carry specific vulnerability to schizophrenia within the three-sibling constellation.

Table 1. Schizophrenic index cases by sibling constellation. (M, male; F, female.)

Sibling constellation by sex			No. of representatives within each constellation and ordinal position			
Ordinal position						
1st	2nd	3rd	Total cases	1st	2nd	3rd
M	M	M	12	6	3	3
M	M	F	20	5	6	9
M	F	M	23	3	9	11
F	M	M	17	5	7	5
F	F	M	24	12	7	5
F	M	F	30	13	5	12
M	F	F	18	6	4	8
F	F	F	12	5	5	2
Totals			156	55	46	55

Table 2. Corrected anticipated incidence, by sibling constellation. (The figures in this table were computed across, separately for each constellation. Totals were obtained by addition.)

Sibling constellation			Breakdown by patient			
Ordinal position			Total cases	Ordinal position		
1st	2nd	3rd		1st	2nd	3rd
M	M	M	12.0	4.0	4.0	4.0
M	M	F	20.0	6.3	6.3	7.4
M	F	M	22.9	7.2	8.5	7.2
F	M	M	17.1	6.3	5.4	5.4
F	F	M	24.0	8.4	8.4	7.2
F	M	F	29.9	10.5	8.9	10.5
M	F	F	18.0	5.4	6.3	6.3
F	F	F	12.0	4.0	4.0	4.0
Totals			155.9	52.1	51.8	52.0

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Persistent Patterns of Wakefulness in the Pretrigeminal Midpontine Preparation

It is well established that wakefulness and its electroencephalographic correlate, low-voltage, fast activity, are maintained by a tonic barrage of impulses arising in the brain-stem reticular formation (*1, 2*; also *3*). Behavioral and electroencephalographic sleep patterns are precipitated when the midbrain reticular formation is widely injured but the classical sensory paths are spared; conversely, interruption of the latter pathways at the midbrain level, with the medially placed reticular formation left intact, does not modify alert behavior and waking electroencephalographic patterns (*2*).

The problem of finding what is the lowest level of brain-stem transection which still permits synchronized electro-

encephalographic patterns throughout the neocortex is of considerable importance, as is that of determining the critical amount of reticular formation which has to remain connected to the cerebrum in order to maintain vigilance. Working with acute preparations, Rossi and Zirondoli (*4*) showed that electroencephalographic sleep patterns were elicited when the transection was slightly rostral to the origin of the trigeminal roots (pretrigeminal section); more caudal lesions, in which all or part of the trigeminal afferent fibers were left intact (posttrigeminal section), were followed by waking electroencephalographic patterns. Later Roger, Rossi, and Zirondoli (*5*) contributed experiments suggesting that the different electroencephalographic patterns displayed by the two types of preparations were dependent, respectively, on the maintenance or the elimination of the tonic flow of afferent trigeminal impulses. However, new data and a revised interpretation are provided by the experiments reported here (*6*).

Under ether anesthesia and with aseptic techniques, cats carrying screw electrodes implanted in the skull were subjected to complete electrolytic transection of the brain stem at the pontine level. In all instances, and as controlled by serial histological examination, the transection was such as to interrupt all connections between the trigeminal nerves and the cerebrum (pretrigeminal section). All animals showed spontaneous respiration and decerebrate rigidity. Our observations always started immediately after completion of the experimental procedures, and most preparations were followed for long periods of time—that is, up to 9 days after the pontine transection. The electroencephalogram was recorded on an ink-writer from frontal, parietal, and occipital areas of both hemispheres. The behavioral tests were limited to observations of spontaneous and provoked ocular movements and changes in pupillary diameter, the third and fourth pairs of cranial nerves being the only motor pathways leaving the central nervous system rostral to the transection.

When the transection was performed through the middle part of the pons [pretrigeminal midpontine preparation (Fig. 1*A*)], the electroencephalographic patterns consisted of low-voltage, fast rhythms, similar to those characteristic of alert behavior in the normal cat. A peculiar feature was their persistence throughout the survival time, with only infrequent and short-lasting interruptions by sleep patterns (characterized by high-voltage, slow waves). Hourly electroencephalographic examination, for not less than 24 consecutive hours, of the same cats before and after midpontine transection brought out some striking differences. While the normal intact cats, when isolated in a quiet environment, would display low-voltage, fast electroencephalographic activity for not more than 20 to 50 percent of the total recording time, a waking electroencephalographic pattern persisted in the midpontine preparations for at least 70, and frequently 90, percent of the total time of recording, in spite of the complete absence of any intentional stimulation.

Separate controls showed that the low-voltage, fast rhythms corresponded to the usual electroencephalographic patterns of wakefulness. The possibility that there was abnormal flattening due to depression or deterioration of cortical neurons was disproved by the following evidence: (i) The arterial pressure ranged from 120 to 140 mm-Hg; (ii) no cerebral edema was present; (iii) cortical excitability was good, as demonstrated by the response of the visual area to photic stimuli and to topical application of 0.1-percent strychnine; and (iv) spindle bursts and slow waves could be reversibly induced by small amounts of pentobarbital. Furthermore, the low-voltage, fast activity was usually accompanied by behavioral correlates suggestive of wakefulness. As a matter of fact the midpontine preparation was able to follow with vertical eye movements an object entering its visual field and sometimes reacted with pupillary dilatation to an emotional stimulus, such as the presentation of a dog or a mouse. Although it may be doubtful that the eye movements observed in our experiments were a sign of conscious behavior, it should be stated that such eye movements were absent whenever electroencephalographic sleep patterns were being recorded. Hence, our data provide convincing evidence that the normal sleep-wakefulness rhythm, or at least its electroencephalographic correlate, is definitely altered by a midpontine transection and replaced by an enduring state of vigilance. However, there is no evidence suggesting a parallel increase in the intensity of alertness.

An opposite alteration of the sleep-wakefulness rhythm was induced by slightly more rostral transections of the pons [pretrigeminal rostropontine preparations (Fig. 1*B*)], which were followed by lasting patterns (up to 7 days) of electroencephalographic synchrony, associated with the usual ocular signs of sleep (such as myosis and lack of purposeful eye movements). These lesions probably correspond to Rossi and Zirondoli's "pretrigeminal" transections.

One important conclusion must be emphasized. Of the two preparations (the "rostropontine" and the "midpontine pretrigeminal" cats, both connected to sensory receptors through the first two cranial nerves only), the former displays a permanently synchronized electroencephalogram, whereas the latter shows a clear-cut desynchronization. Thus, the critical factor is the injury or the integrity of a small amount of nervous tissue lying in the rostral part of the pons.

The shift in the normal sleep-wakefulness rhythm toward a state of endur-

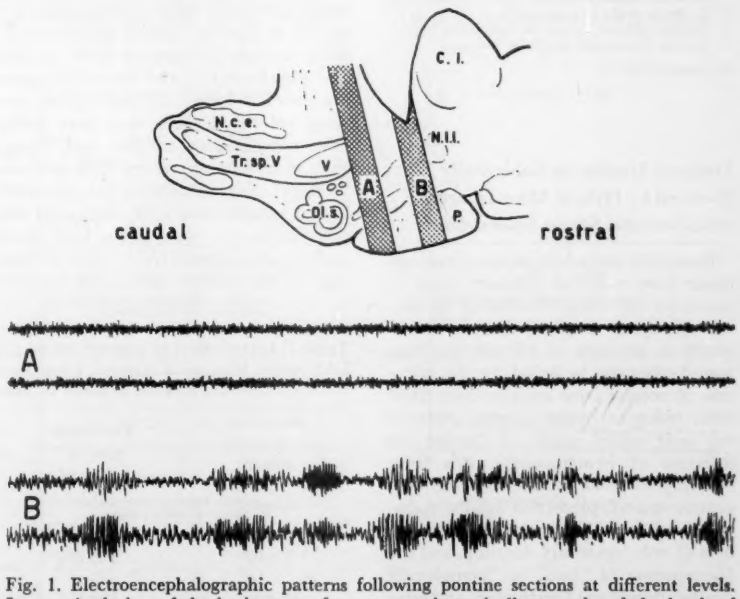

Fig. 1. Electroencephalographic patterns following pontine sections at different levels. In a sagittal view of the brain stem of a cat are schematically reproduced the levels of midpontine (*A*) and rostropontine (*B*) transections. Samples of the corresponding electroencephalographic patterns (recorded from right and left frontal areas, respectively) appear below the diagram. *C.i.*, inferior colliculus; *N.c.e.*, nucleus cuneatus externus; *N.l.l.*, nucleus of lateral lemniscus; *Ol.s.*, superior olive; *P.*, brachia pontis; *Tr.sp.V.*, spinal tract of trigeminal nerve; *V.*, pontine trigeminal sensory nucleus.

ing wakefulness which seems to be characteristic of the midpontine preparation deserves more attention, and its mechanisms are being presently investigated (*7*). Suffice it to say here that the behavioral and electroencephalographic patterns of the "midpontine" animal do not appear to result from hypoventilation and consequent hypercapnia, as demonstrated by blood gas measurement before and after appropriate brain-stem transection (*7*). A synchronizing, or possibly sleep-inducing, influence exerted by some structure in the caudal brain stem can be tentatively envisaged, and its existence will be tested experimentally. This might provide a new interpretation of Roger, Rossi, and Zirondoli's finding (*5*) that trigeminal deafferentation precipitates electroencephalographic sleep patterns in the *encéphale isolé* cat.

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30 January 1958

Delayed Deaths in Sublethally X-rayed F_1 Hybrid Mice Injected with Parental Strain Spleen Cells

Essentially permanent protection against death from radiation exposure (that is, protection for a large fraction of the normal life span) is afforded in mice subjected to amounts of x-irradiation that would otherwise be lethal, by the injection of normal bone marrow cells taken from isologous mouse donors (mice of the same inbred strain). Following the injection of hematopoietic cells from homologous donors (mice of a different genetic strain), protection against radiation death is either greatly decreased (*1*) or is of only temporary duration, and the phenomenon of "late" or "homologous deaths" during the fourth week and later becomes evident (*2*). During the course of studies (*3*) on the role of the lymphoid tissues in this "homologous disease" (*4*), it was observed that the injection of normal parental strain spleen cells into nonirradiated, or into sublethally x-irradiated, F_1 hybrid mice resulted in delayed deaths (*5*).

Ten-month-old male mice (strain C57L × A, F_1 hybrids) were the recipients. The donors of the spleens were 10- to 25-week-old mice of the A strain. Nonirradiated LAF_1 mice, and also mice exposed to a sublethal radiation dose [500 r of 250-kvp (peak) x-rays] received a single intraperitoneal injection of A-strain spleen cells, as homogenate, in Tyrode's solution containing 4 mg of penicillin. The results are summarized in Table 1. It is evident that the injection of A-strain spleen cells leads to delayed deaths—in mice irradiated with 500 r during the second, third, and fourth weeks and in nonirradiated mice, at 3 to 8 weeks. The lethal effect in the nonirradiated mice appeared to be dependent in part on the size of the spleen cell inoculum—the larger the number of cells injected, the earlier the deaths. The general appearance of these mice (Fig. 1) is reminiscent of that of irradiated mice with homologous disease following injection of homologous bone marrow; debilitation, body-weight loss, and atrophic spleen and thymus were noted. The lethal effect could not be duplicated by the injection of LAF_1 spleen cells into other LAF_1 mice or into A-strain mice.

It seems plausible that the above-described phenomenon is in the nature of a reaction against the host—possibly the homograft type of reaction (*6*)—of injected spleen cells capable of producing immunoreaction. Since A-strain mice are known to have the specific histocompatibility antigen (designated *H-2*^{a}) at the *H-2* gene locus (*7*), and since C57L mice are known to have a different specific antigen (*H-2*^{b}), it is evident that LAF_1 mice contain both antigens and, therefore, that A-strain spleen cells are not "foreign" antigenically to the immunological apparatus of LAF_1 mice. On the other hand, the tissues of the LAF_1 host contain an antigen (*H-2*^{b}) that is "foreign" to the A-strain spleen cells injected into their midst. Under these circumstances, immunological reactivity can take place only in one direction, and we see, in effect, the "rejection" of the host tissues by the injected A-strain spleen cells.

Fig. 1. Typical "homologous disease" in mouse of strain LAF_1 previously subjected to sublethal dose (500 r) of x-irradiation, 35 days after injection of 12×10^6 nucleated cells from A-strain mice.

The similarities between the above phenomenon and that of "homologous disease" in x-irradiated mice (at LD_{100} doses) injected with homologous bone marrow cells is perhaps more than fortuitous. It is suggested that this latter syndrome may be a consequence, at least in part, of transfer of cells in the injected bone marrow suspension, capable (or potentially capable) of producing immunoreaction. According to this view, attempts to remove or inactivate such cells in the donor bone marrow could conceivably reduce the potential hazard of homologous reactions following the administration of nonisologous marrow as therapy for acute radiation sickness.

Note added in proof. It has been found (*8*) that the lethal effect of injected parental spleen cells is not duplicated by the injection of A-strain spleen cells lysed in distilled water, nor by injection of 40 mg of A-strain liver as a homogenate in Tyrode's solution. Thymus cells have been found to be much less active than cells from spleen. Thus 12×10^6 nucleated thymus cells (from

Table 1. Lethal effect of injected spleen cells from A-strain mice in normal and irradiated LAF_1 mice. Mice were injected a few hours after irradiation unless otherwise indicated; the number of test animals is shown in parentheses.

No. or wt of A-strain spleen cells injected	Radiation dose to recipient (r)	Mortality	
		No.	Days after irradiation
6.5×10^6	500 r	5 (5)	9, 10, 10, 12, 12
3.2×10^6	500 r	4 (4)	12, 12, 12, 28
16×10^6	500 r	1 (1)	12
(85 mg)	500 r	7 (7)	14, 17, 19, 19, 25, 26, 26
(82 mg) *	500 r	6 (6)	24, 26, 27, 31, 31, 20
6.5×10^6	None	1 (5)	55
16.4×10^6	None	5 (5)	24, 27, 28, 42, 42
33×10^6	None	4 (4)	17, 20, 20, 20

* Injected 6 days after irradiation.

9-week-old A-strain mice) elicited death (at 49 days) in only one of seven sublethally x-rayed 4-month-old LAF_1 mice, whereas 12×10^6 spleen cells produced deaths in all of 17 similarly irradiated LAF_1 mice. Of considerable interest, furthermore, is the observation that injection of 12×10^6 cells taken from newborn (1 to 4 days old) mice of strain A did not elicit any deaths (by 5 months, at this writing). On this basis, experiments are now in progress to test the feasibility of preventing the secondary "homologous disease" in lethally x-irradiated LAF_1 mice (870 r) by injection of spleen cells from newborn strain-A mice. It appears, thus far, that such cells afford 100 percent protection against deaths during the three months after irradiation.

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13 January 1958

New Technique for Recording Skin Resistance Changes

The aspects of skin resistance commonly measured are specific responses (psychogalvanic reflex), nonspecific fluctuations, and basal resistance level. The basal resistance is usually noted periodically and is regarded chiefly as a reference level for specific and nonspecific responses. This report describes information obtained when basal skin resistance is recorded continuously.

A specially constructed skin resistance meter (*1*) receives the input from the subject. Output from this meter is passed through a Brush amplifier to a Brush two-channel magnetic oscillograph. The write-out is calibrated at 1 cm/12 min on the abcissa and at 1 cm/10,000 ohm on the ordinate. Classical galvanometric measurement of skin resistance, on the other hand, is often recorded at 1 cm/2 sec on the abcissa and at 1 cm/250 ohm on the ordinate. The continuous basal resistance recording is, therefore, 1/180 of the abcissa as recorded by the classical procedure and 1/40 of the ordinate.

Dry plantar electrodes (*2*), measuring approximately 7 by 10 cm, are employed. These are made of silver conductive cloth, sewed into individually fitted socks, and secured in place by well-fitting shoes. When the environmental temperature is controlled, records are virtually free of artifacts, regardless of whether the subject is standing, sitting, lying, or walking.

This technique gives a clear record of periods of sleep by demonstrating graphically a rise of basal resistance (see Fig. 1, tracing *A*). Alertness is revealed by a line of relatively low resistance. Relaxation and drowse are indicated by gradually rising resistance with infrequent, large fluctuations. This may progress to the high stable resistance of sleep. Fitful sleep is shown by large drops interrupting the high stable line. Periods of arousal during sleep are marked by sharp drops and slow recovery.

The exact point of onset of sleep is not clearly indicated but can be closely approximated by correlation with ability to respond to stimuli such as light flashes or verbal requests. The onset of awakening is clearly indicated on the tracing and is confirmed by behavioral observation. The period of drowse is distinctly different from the awake period. Thus, electronic monitoring of alertness is possible. This is particularly useful in research such as studies of human isolation, where the usual means of observing subjects are not feasible.

A clear graphic picture of activity may be obtained, as illustrated in tracings *B* and *C* of Fig. 1. The difference between the work and relaxation periods is apparent. Since identical experimental procedures were used for making these tracings, the extent of individual variation in the tracings is emphasized. It is also noted that the individual of tracing *C* was "relaxed" when his resistance was higher than that shown by the individual of tracing *A* when asleep.

Tracings *D*, *E*, and *F* are individual records obtained from three additional subjects while alert, with minimal external stimulation. The degree of basal resistance reactivity was judged qualitatively, as shown in the figure. Recordings have been obtained from 22 subjects. Seven have been judged hyporesponsive, eight normoresponsive, and seven hyperresponsive. Five subjects have been tested repeatedly. While mild variability in response pattern was noted, their tracings always fell in the original categories.

In general, hyperresponsive tracings are obtained from subjects who can relax easily, while hyporesponsive tracings are obtained from subjects who do not relax easily. Work is now under way to correlate these skin resistance response

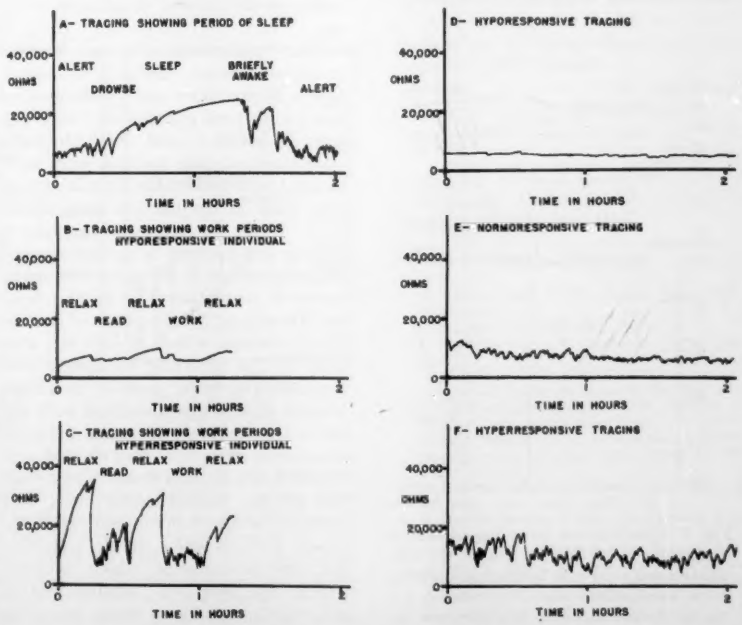

Fig. 1. Slow write-out of skin resistance.

patterns with (i) other personality factors and (ii) vascular response patterns.

To obtain suitable records for judgment of response pattern, it is necessary to control the circumstances under which the tracing is made. Sensory input and physical activity, for instance, must be held relatively constant.

The write-out demonstrates: (i) whether the subject is asleep, drowsy, or awake; (ii) whether he is active or relaxed; and (iii) which of several patterns of response he demonstrates.

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Notes

1. The skin resistance meter was designed by Edward Correll of our laboratory in collaboration with Neil Burch.
2. The dry plantar electrodes were developed by Nina K. Morrison of our laboratory.

13 February 1958

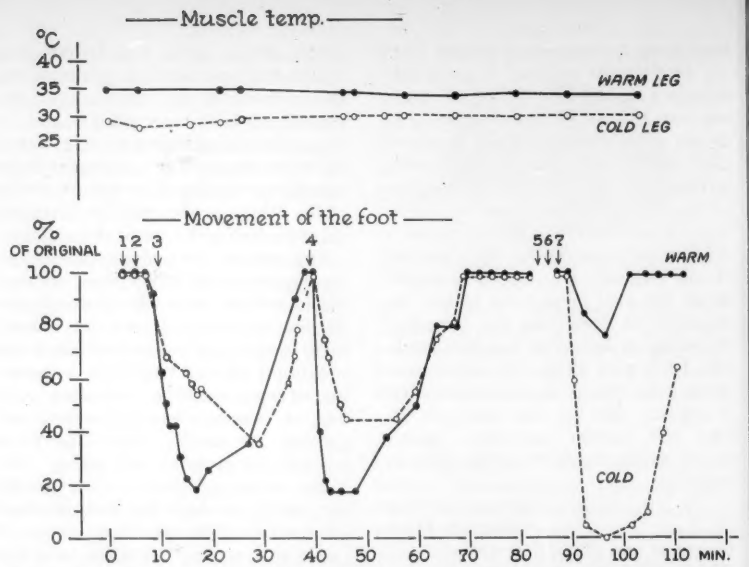

Fig. 2. Simultaneous recording of muscle temperature and the response of the tibialis anterior muscle to indirect stimulation in an anesthetized man. At arrows 1 and 4, 6 mg, and at arrows 2 and 3, 3 mg, of tubocurarine chloride were injected intravenously. At arrows 5, 6, and 7, 2-mg doses of decamethonium diiodide were injected intravenously.

Effects of Lowered Muscle Temperature upon Neuromuscular Blockade in Man

In cats, changes in muscle temperature have a marked influence on the action of neuromuscular blocking drugs (*1*). Experiments both in the intact animal and on isolated tissues have shown that lowering the muscle temperature increases the magnitude and the duration of the action of depolarizing neuromuscular blocking drugs (*2*). This effect is reversed on rewarming. Furthermore, it has been found that the nature of the block is in no way affected by the time duration of the paralysis. On the other hand, when substances, such as tubocurarine, which block by competition with acetylcholine are used, the magnitude of the blockade is reduced by cooling, but the duration of action is only slightly affected. A reduction in the action of tubocurarine by cooling was reported by Holmes *et al.* (*3*) from experiments on the isolated diaphragm of the rat.

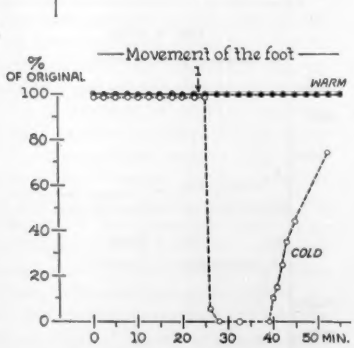

Fig. 1. Simultaneous recording of muscle temperature and the response of the tibialis anterior muscle to indirect stimulation in an anesthetized man. At arrow 1, 1.5 mg of decamethonium diiodide was injected intravenously.

This preliminary report describes analogous results obtained in human beings. Experiments were performed on nine anesthetized patients and two volunteers, in whom a total of 21 blockades were observed. The patients were anesthetized with a short-lasting thiobarbiturate, used in conjunction with nitrous oxide. While the muscle temperature of one leg was lowered by surface cooling, the temperature of the other was maintained at normal level by surface heating. Thermistor needles, inserted into the tibialis anterior muscle of each leg, were used for the recording of muscle temperature. The motor point of the tibialis anterior muscle was stimulated with surface electrodes every 10 seconds, and the movements of the foot thus elicited were recorded on a smoked drum. Three drugs that produce neuromuscular block were studied—decamethonium and suxamethonium, both of which mimic acetylcholine, and tubocurarine, which competes with it. The drugs were administered intravenously, usually as single injections or occasionally in the form of a slow, continuous infusion. A lowering of muscle temperature of 3° to 5°C always increased the magnitude and the duration of a blockade produced by decamethonium and suxamethonium, the duration being affected to a greater extent than the magnitude. Figure 1 illustrates diagrammatically the results obtained in an anesthetized patient. When the muscle temperature of the cooled leg reached 30°C, 1.5 mg of decamethonium was administered intravenously. This dose produced no paralysis in the warm leg, but there was no movement of the cool leg in response to indirect electrical stimulation for 10 minutes. Similar results were obtained with suxamethonium. Thus, the results obtained with depolarizing drugs in human beings are similar to those obtained in cats.

In three of six experiments with tubocurarine, the warm leg was affected more than the cold one; in one, the effect was the same in both legs; and in two, the cold leg was affected slightly more. A possible explanation of this apparent inconsistency lies in the recording system, which was neither sufficiently stable nor sufficiently sensitive to detect small changes. Experiments now in progress in which muscle tension is recorded electrically are providing data in close agreement with those obtained in cats.

Figure 2 illustrates the results obtained in a subject in whom neuromuscular block was produced three times in succession, in the first two instances by tubocurarine and in the third, by decamethonium. The magnitude of the two tubocurarine blocks was reduced by cooling, but that of the decamethonium block

was increased. This demonstrates that the mode of action of decamethonium is fundamentally different from that of tubocurarine and suggests that this mode of action is not altered when tubocurarine has been previously administered.

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30 January 1958

Genetic Control of Some Human Serum β-Globulins

The presence, demonstrated by two-dimensional starch-gel electrophoresis (*1*), of an additional β-globulin (D) in the serum of seven individuals (two New York negroes and five Australian aborigines) has been reported by Smithies (*2*). β-Globulin D was present in these sera in approximately the same amounts as β-globulin C. In the several hundred sera previously examined (largely from individuals of European ancestry) β-globulin D was not observed, although β-globulin C was always present.

More work has been carried out with further samples of serum from the five Australian aborigines having both β-globulins C and D, and with sera from other members of their community and race. In all, sera from over 120 aborigines (including several large families) have been examined, and a third β-globulin type has been observed in which β-globulin D is present but β-globulin C is absent. The over-all results suggest that the presence or absence of the β-globulins C and D is under simple genetic control.

The following hypothesis for the genetic control of the β-globulins C and D is completely consistent with the data obtained from the families studied. Two autosomal alleles (β^C and β^D) with no dominance are provisionally postulated. The genotype β^C/β^C leads to the presence of β-globulin C in the serum and to the absence of β-globulin D. The heterozygous combination of genes, β^C/β^D, leads to the presence of both β-globulins C and D in the serum in approximately equal amounts. The third genotype, β^D/β^D, leads to the presence of β-globulin D in the serum and to the absence of β-globulin C. This genetic hypothesis is similar to the three-allele hypothesis proposed by Smithies and Hickman for the control of the five β-globulin types which they have observed in cattle (*3*). It differs from the genetic hypothesis involving five pairs of linked genes referred to by Ashton (*4*) in an independent investigation of the β-globulin variations in cattle.

Figure 1 illustrates diagrammatically the appearance of the two-dimensional starch-gel electrophoresis patterns of the β-globulins in the three phenotypes and gives the postulated genotypes. When

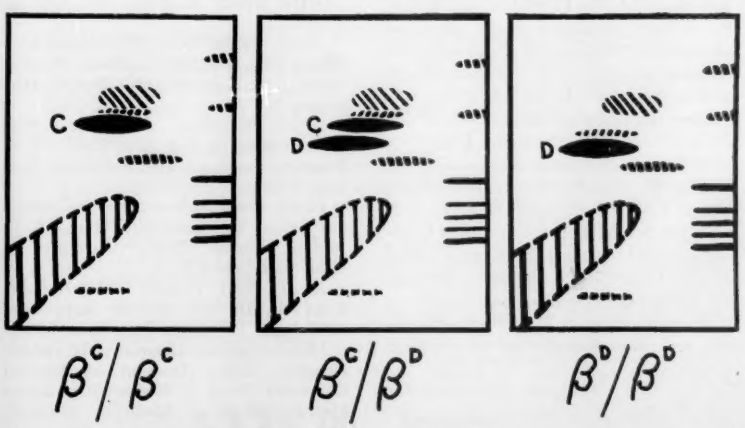

Fig. 1. Diagramatic representation of the stained proteins in the starch gels from two-dimensional electrophoresis (*1*) experiments with the serum β-globulins in the three phenotypes. β-Globulins C and D are labeled in the diagram, and the postulated genotypes are indicated. Each serum sample was first subjected to electrophoresis on filter paper, and that part of the resulting strip over which the β-globulins were distributed was then inserted into a starch gel for the second electrophoresis at right-angles to the first. The β-globulins appear in the central area of each section of the diagram; some of the γ-globulins are to the left of the β-globulins, and some of the α_2-globulins are to the right.

Table 1. Observed distribution of the β-globulin types in the sera of the offspring of those Australian aborigine families in which both parents and at least one child were tested for their β-globulin types, compared with the distribution expected from the genetic hypothesis here considered. The ratios given are (observed/expected).

Matings		Distribution of β-globulin types in offspring		
Observed	No.	βCC	βCD	βDD
βCC × βCC	6	17/17.0	0/0.0	0/0.0
βCC × βCD	6	9/ 9.0	9/9.0	0/0.0
βCC × βDD	1	0/ 0.0	6/6.0	0/0.0

sera from the two homozygotes (β^C/β^C and β^D/β^D) are mixed in equal amounts, and the mixture of the two sera is subjected to two-dimensional electrophoresis, the resulting pattern of the serum proteins is indistinguishable from the pattern given by the heterozygote (β^C/β^D), as far as the β-globulins are concerned.

Table 1 summarizes the data obtained from those of the Australian aborigine families studied in which both parents and at least one child were tested for their β-globulin types. The agreement between the observed distribution of β-globulin types in the offspring and the distribution expected from the genetic hypothesis here suggested is excellent.

The haptoglobin types (*5*) of the individuals included in the present study of serum β-globulins were also determined. The genes controlling the haptoglobin types (*6*) and those proposed for the β-globulin types were observed to segregate independently in the one family of those studied in which such independent segregation was theoretically detectable (*7, 8*).

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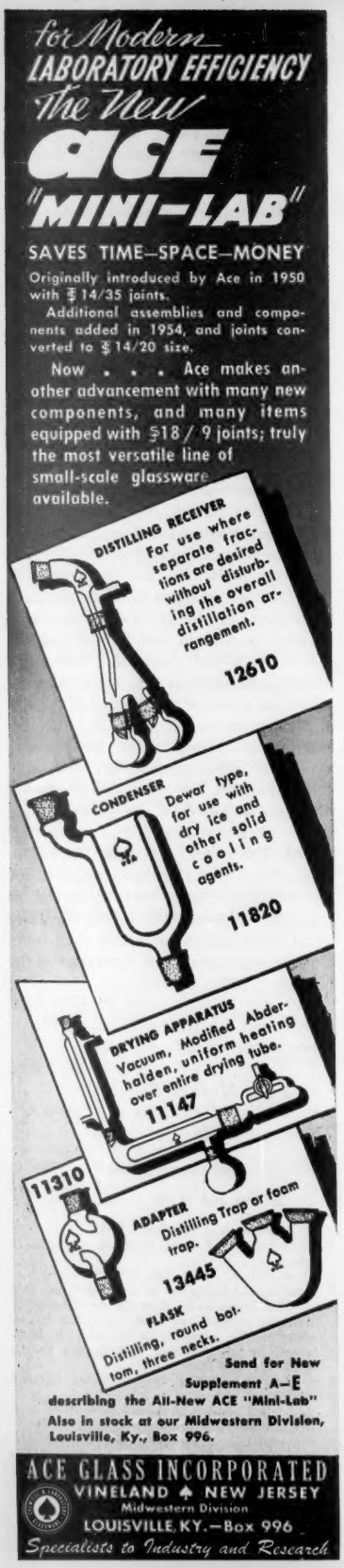
5. The haptoglobulins are serum α_2-globulins able to bind hemoglobin; they can be classified in different persons into three types. The haptoglobulin type shown by an individual is determined by his genotype with respect to the alleles Hp^1 and Hp^2.
6. O. Smithies and N. F. Walker, *Nature* **178**, 694 (1956).
7. A detailed account of these investigations is in preparation.
8. We gratefully acknowledge the help of Mr. Norman A. Ferris, superintendent of the Mona Mona Mission, in this study, and the technical assistance of Mr. Otto Hiller in the performance of the starch-gel tests.

24 December 1957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Meetings

AAAS Southwestern and Rocky Mountain Division

The annual meetings of the Southwestern and Rocky Mountain Division, AAAS, were held on the campus of the New Mexico Highlands University, in Las Vegas, 27 April–1 May 1958.

Programs of the four sections of the division included 54 individual research papers. In addition, two symposia consisting of invited papers were conducted. One of these, sponsored by the division's Committee on Desert and Arid Zone Research, extended through two sessions. The subject, "The Bioecology of Arid Lands," was presented by eight specialists in as many facets of this topic. A great deal of interest was shown in the continuation of a series of symposia on "Improvement of Science Teaching." Both the secondary schools and the colleges of the region were represented by the six panelists on this program.

The division's annual John Wesley Powell memorial lecture was given by Victor Regener, professor of physics at the University of New Mexico. He spoke on "The progress of the International Geophysical Year."

The retiring president of the division, Morris F. Stubbs, professor of chemistry at the New Mexico Institute of Mining and Technology, delivered the presidential address on "Some natural resources of New Mexico and their possible effects on the future of the state."

Newly elected officers of the division include: Albert R. Mead, University of Arizona, president; Lora M. Shields, New Mexico Highlands University, vice president; Morris F. Stubbs and Edwin R. Helwig, members of the executive committee. Marlowe G. Anderson will continue as executive secretary-treasurer, and representative to the AAAS Council.

New chairmen of the sections of the division are: W. G. Solheim, University of Wyoming, Botanical Sciences Section; Wesley W. Wendlandt, Texas Technological College, Physical Sciences Section; Joe Ben Wheat, University of Colorado, Social Sciences Section; T. Paul Maslin, University of Colorado, Zoological Sciences Section.

The University of Wyoming, at Laramie, was selected as the site for the 1959 meetings.

MARLOWE G. ANDERSON
State College, New Mexico

Forthcoming Events

August

4–9. Microbiology, 7th intern. cong., Stockholm, Sweden. (F. C. Harwood, Soc. of American Bacteriologists, c/o Waverly Press, Inc., Mt. Royal and Guilford Aves., Baltimore 2, Md.)

7–9. Electron Microscope Soc., annual, Los Angeles, Calif. (C. M. Schwartz, Battelle Memorial Inst., 505 King Ave., Columbus 1. Ohio.)

10–16. Radiation Research, intern. cong., Burlington, Vt. (H. M. Patt, Argonne National Lab., P.O. Box 299, Lemont, Ill.)

11–13. International Mathematical Union, 3rd general assembly, St. Andrews, Scotland. (F. Smithies, Mathematical Inst., 16 Chambers St., Edinburgh 1, Scotland.)

11–16. Occupational Therapists, World Federation's 2nd intern. cong., Copenhagen, Denmark. (Mrs. I. Worsoe, Hvidkloververj 10, Aarhus, Denmark.)

12–13. Economic Botany Conf., New York, N.Y. (D. J. Rogers, New York Botanical Garden, Bronx Park, New York 58.)

13–15. Electronic Standards and Measurements Conf., Boulder, Colo. (J. F. Brockman, National Bureau of Standards, Boulder.)

13–15. Industrial Applications of X-ray Analysis, 7th annual conf., Denver, Colo. (W. M. Mueller, Metallurgy Div., Denver Research Inst., University of Denver, Denver 10.)

13–19. Seaweed Symposium, 3rd intern., Galway, Ireland. (C. O. hEocha, Chemistry Department, University College, Galway.)

13–20. Insect Pathology and Biological Control, intern. conf., Prague and Smolenica, Czechoslovakia. (J. Weiser, Inst. of Biology, Nacvicisti 2, Prague XIX, Czechoslovakia.)

13–20. International Astronomical Union, 10th general assembly, Moscow, U.S.S.R. (P. Th. Oosterhoff, IAU, Leiden Observatory, Leiden, Netherlands.)

15–20. World Medical Assoc., 12th general, Copenhagen, Denmark. (World Medical Assoc., 10 Columbus Circle, New York 19.)

17. American College of Hospital Administrators, 24th annual, Chicago, Ill. (ACHA, 620 N. Michigan Ave., Chicago 11.)

17–21. Health Conf., 7th annual, University Park, Pa. (M. Cashman, Pennsylvania Dept. of Health, P.O. Box 90, Harrisburg.)

18–19. American Astronautical Soc., Western meeting, Palo Alto, Calif. (N. V. Petersen, Lockheed Missile Systems Div., Palo Alto.)

18–21. Conservation Education Assoc., 5th annual, Salt Lake City, Utah. (S. D. Mulaik, Biology Dept., University of Utah, Salt Lake City.)

18–21. Heat Transfer, AIChE conf., Evanston, Ill. (F. J. Van Antwerpen, AIChE, 25 W. 45 St., New York 36.)

18–22. Clinical Chemistry Workshop, Houston, Tex. (Division of Clinical Chemistry, Dept. of Biochemistry, Baylor Univ., College of Medicine, Houston. 25.)

18–22. Occupational Medicine and Toxicology, 2nd Inter-American conf., Miami, Fla. (W. B. Deichmann, Dept. of Pharmacology, Univ. of Miami School of Medicine, Coral Gables, Fla.)

18–22. Plant Science Seminar, 35th annual, Big Rapids, Mich. (E. P. Claus, Div. of Pharmacy, Ferris Inst., Big Rapids.)

18–22. Semiconductors, intern. conf., IUPAP, Rochester, N.Y. (D. L. Dexter,

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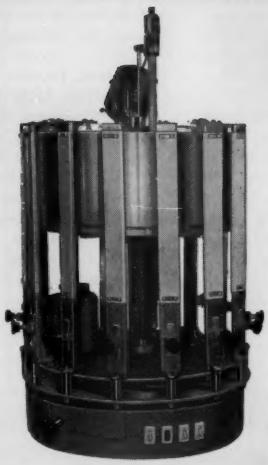

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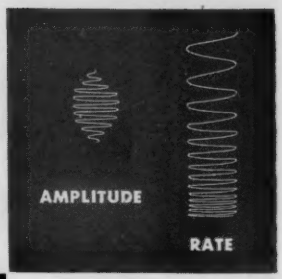

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Dept. of Physics, Univ. of Rochester, Rochester.)

18–23. New England Assoc. of Chemistry Teachers, 20th summer, Kingston, R.I. (J. A. Martus, College of the Holy Cross, Worcester 10, Mass.)

18–25. Religion in the Age of Science, 5th summer conf., Star Island, N.H. (Institute on Religion in an Age of Science, 280 Newton St., Brookline 46, Mass.)

20–23. Photofluorography, intern. cong., Stockholm, Sweden. (International Cong. of Photofluorography, P.O. Box 5097, Stockholm 5.)

20–27. Australian and New Zealand Assoc. for the Advancement of Science, 33rd cong., Adelaide, Australia. (J. R. A. McMillan, Science House, 157–161 Gloucester St., Sydney.)

20–27. Genetics, 10th intern. cong., Montreal, Canada. (J. W. Boyes, Dept. of Genetics, McGill Univ., Montreal.)

21–23. American Farm Economic Assoc., Winnipeg, Canada. (L. S. Hardin, Dept. of Agricultural Economics, Purdue Univ., Lafayette, Ind.)

21–23. Chemical Organization of Cells, Normal and Abnormal, Madison, Wis. (J. F. A. McManus, Dept. of Pathology, Univ. of Alabama Medical Center, Birmingham.)

(*See issue of 20 June for comprehensive list*)

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Letters

Behavioral Science

Your editorial on the desirability of "team projects" to produce "a unified theory" in "behavioral science" [*Science* **127**, 933 (1958)] stimulates several comments. Agreement with your conclusion that there are better "ways to spend money in this science" does not prevent disagreement on the reasons leading to it—and other matters.

As the editorial states, studies of social and physical phenomena—by some method—are similar in age. However, the study of human behavior by the methods of science is a recent thing. This "newness" has at least two implications:

1) It is premature to assume that the various studies of man (biological, psychological, social, cultural, and so on) will ever produce a body of knowledge of a size and compactness comparable to that of modern physics. Perhaps they will develop several bodies of knowledge closely related and interpenetrating, as, for example, chemistry, physics, and astronomy. Perhaps psychology, sociology, and anthropology—properly delimited—will prove to be as disparate but complementary as, say, geology, climatology, and paleontology. Is it not too early to state that the sciences of man and other social organisms will, or will not, produce a unified theory?

2) What do these new sciences-in-becoming now have to contribute toward a unified theory? Only psychology, perhaps, is well started on the development of a theory—that is, a system of tested propositions. The others have some generalizations to offer which are well replicated but which, in the main, are disconnected. While an exaggeration, the *mot* of a former colleague comes to mind: "The calculus is not the only place where you can't integrate nothing!"

I conclude that (i) we students of human behavior have every right to work toward a unified theory, alone or in teams, and "perennially" if we choose; (ii) at the moment, the slow, painstaking formulation, testing, and retesting of theoretical propositions is a more profitable use of time and what little money we are allotted.

Must *Science* perpetuate a misnomer like "behavioral science," however popular and widespread its use has become? Why do not those who study the "behavior" of protons, molecules, cells, or even galaxies object to this "steal" as loudly and legitimately as students of social phenomena should object to the reservation of "natural science" for studies of physical phenomena? However, an appropriate name for this division of the scientific enterprise continues to elude us. The "social sciences," the "behavioral sciences," the "sciences of man," the

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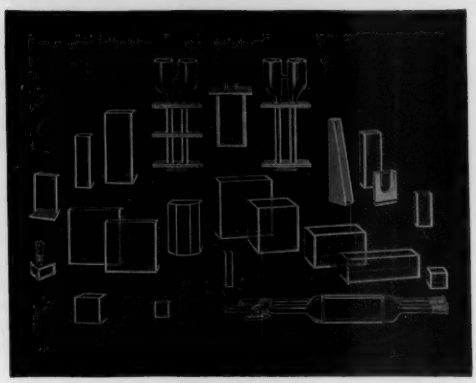

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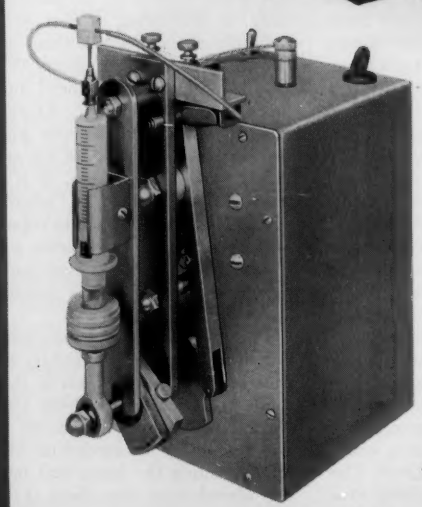

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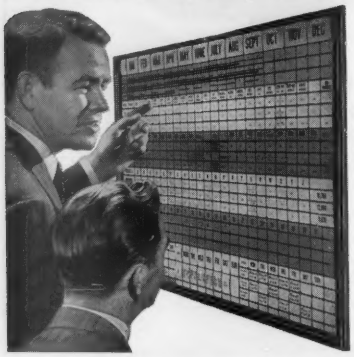

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"sciences of human behavior"—all include too much or too little. Suggestions anyone?

MORTON KING, JR.
Department of Sociology, Northwestern University, Evanston, Illinois

Fallout Near Nevada Test Site

Concerning "Strontium-90 in man" [*Science* **127**, 266 (1958)], I wish to point out the urgent need for public information on such radioactive fallout burdens being carried by populations in the vicinity of the Nevada test site. The problem of local fallout from atomic weapons tests seems to be a neglected subject, and obviously important data are not available to the interested citizen.

One cannot find or elicit more than a few items of indirect data on the strontium-90 content of human bone, soil, or food derived from the area in southern Utah most heavily contaminated with fallout from Nevada tests. This is an obvious area for intensive investigation, since it is known that some 10,000 persons in southern Utah have been subjected to fallout equalling a full-body gamma-ray dose in the range of 3 to 4 roentgens. This dose amounts to at least 30 times what most other persons in the United States have had to absorb, and indicates the possibility that there are unusually high strontium-90 burdens for that group.

Written requests for information on this subject were sent to the Utah State Department of Health, the Office of Test Information of the Nevada Test Organization, and the Atomic Energy Commission at the highest levels. The Atomic Energy Commission replied, "we have no samples of human bone from Utah," although Commissioner Libby has reported a few analyses of stillborns dated 1954 from central Utah. It was learned from C. L. Dunham, Division of Biology and Medicine, Atomic Energy Commission, that a dozen soil samples from southern Utah and Nevada were taken in the summer of 1957 and will be analyzed for strontium-90 in the near future. None of these agencies furnished the data needed to resolve the local strontium-90 question.

As a temporary substitute for actual data, I have attempted to estimate the strontium-90 fallout in southern Utah, using the known gamma field and the fission yield for strontium-90. Fractionation and weathering effects were ignored, but the method checked well against strontium-90 data for the Pacific islands. The details will be published in the 1957 *Proceedings of the Utah Academy of Sciences, Arts and Letters*. The result is that those areas which received 4 roentgens of gammas probably now have 245 ± 50 mc of strontium-90 per square mile of soil. I understand through Dunham that the Atomic Energy Commission has made a comparable calculation, based on somewhat more optimistic assumptions, leading to a prediction of unweathered strontium-90 fallout of 160 mc/mi².

In the region of concern, the people consume a relatively high proportion of home- or locally grown vegetables and milk products.

These figures mean that by 1970 several thousands of residents of southern Utah will probably carry a bone burden of strontium-90 in excess of 100 "sunshine units" as a result of Nevada tests to date. That conclusion is based on authoritative estimates of exchangeable calcium in the soil and on the method of calculating strontium-90 transmission along the ecological chain presented recently by J. D. Teresi and C. L. Newcombe [U.S. Naval Radiological Defense Laboratory, *Reviews and Lectures, No. 47* (9 Aug. 1957)].

One hundred "sunshine units" of strontium-90 represents a recognized level of alarm for adult populations and worse than that for children. Clearly, there is an urgent need for more information on fallout effects in southern Utah, and for changes in nuclear testing policy.

Recently the National Committee on Radiation Protection and Measurement lowered the maximum permissible radiation dose for workers in and around industrial nuclear operations and for other groups. The new maximum permissible radiation dose of 0.5 rem per body per year applicable to populations is less than one-seventh the dose rate (3.9 r/yr) which the Atomic Energy Commission has assured us is "safe" for areas adjacent to Nevada bomb tests. The term *safe* when applied to 3.9 roentgens, full body, is misleading at best and refers only to gamma effects, without considering the associated strontium-90 hazard.

It is not clear from official announcements whether the Atomic Energy Commission will adopt the new maximum permissible radiation dose for areas adjacent to bomb test sites, as it has for industrial operations, or whether the commission will continue to regard these as "controlled areas." Surely a double standard should not prevail unless the populations concerned are informed and are willing.

The new maximum permissible radiation dose, if applied uniformly, would at least keep future additions to the strontium-90 burdens in southern Utah and Nevada within more reasonable bounds. However, other measures must be sought for alleviating the harm that has probably already been done there, if the present estimates of the strontium-90 burdens are substantiated by actual analyses of human bone.

NORMAN BAUER
Utah State University, Logan, Utah

Equipment

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■ TRANSISTORIZED RC TIMERS permit measurements of intervals from 50 msec to several hours. Operation may be on 14 to 32 v d-c or 24 to 220 v a-c. Ambient temperature may range from − 55° to + 125°C. Accuracy of timing is ± 2 percent or better. Volume may be as small as 3 in.³ and weight as little as 3 oz. (Victoreen Instrument Co., Dept. 123)

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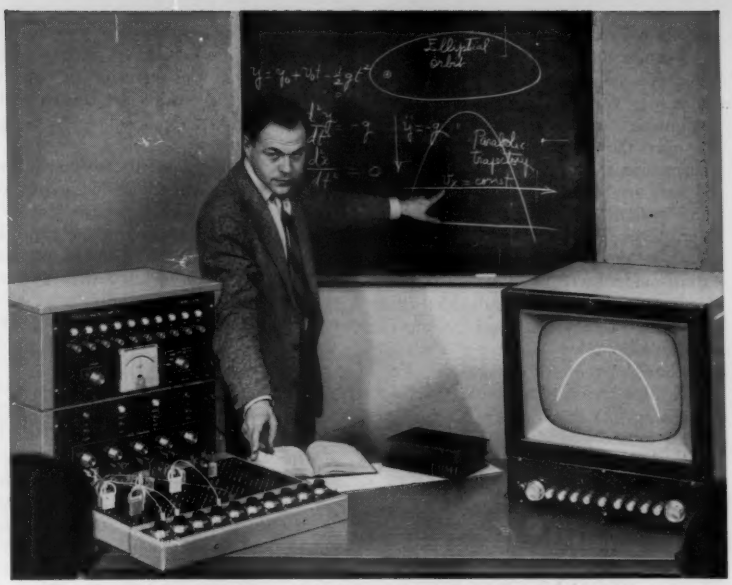

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THE SPECIES PROBLEM

AAAS SYMPOSIUM VOLUME NO. 50
Edited by Ernst Mayr, Harvard University
6 x 9 in., 404 pp., references, index, clothbound, October 1957
Price $8.75; special cash order price for AAAS members $7.50

The symposium was arranged by the Association of Southeastern Biologists and cosponsored by AAAS Sections F and G, as well as four other societies. Most papers are published essentially as given in Atlanta in December 1955. Dr. T. M. Sonneborn, however, undertook a comprehensive survey of the species problem in the protozoans and particularly in the ciliates. His masterly synthesis comprising more than two-fifths of the volume is a fundamental contribution to the protozoan literature.

This symposium made a solid contribution toward the solution of the species problem. It broadened the base on which to discuss the problem by utilizing new organisms. It led to a clarification of the areas of general agreement among biologists. It presented a clear statement of the various species concepts and frankly stated and enumerated difficulties in their application to different types of natural populations. Finally, it illuminated certain aspects of the ageless species problem that had been neglected previously, and it attempted a statement of still controversial issues. From these papers it should be evident that the species problem is still one of the important issues in biology.

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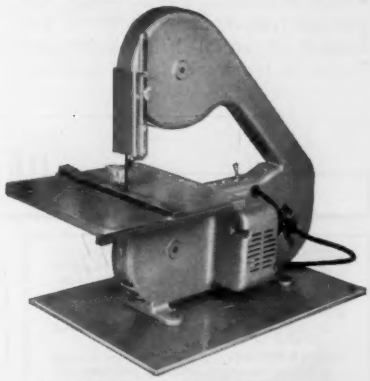

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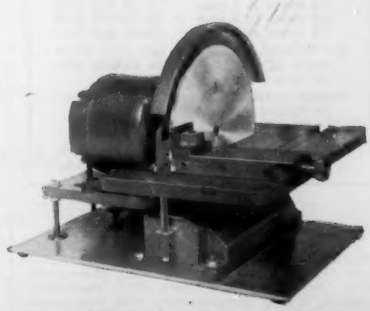

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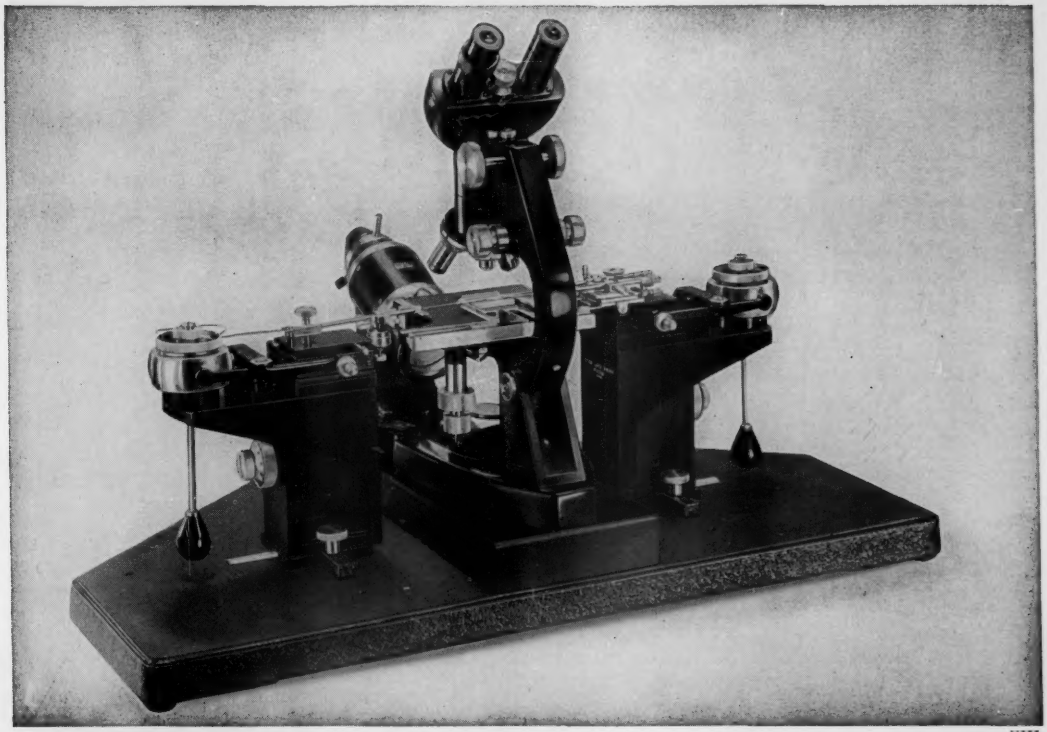

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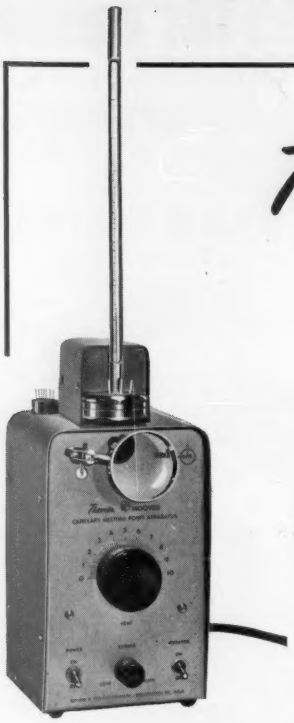

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